Essays in Decision Making

by

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Abstract

This thesis explores the impact of individual decision making on the functioning of firms and markets. The first chapter examines how deviations from strict rationality by individuals impact the market for consumer goods. A growing body of evidence documents individual behavior that is difficult to reconcile with standard models of rational choice, and firm behavior difficult to reconcile with rational markets. In this paper I present a boundedly rational model of choice that reconciles several behavioral anomalies, and provides micro-foundational support for some puzzling empirical regularities in firm behavior. If the evaluation of an alternative is costly, individuals may find it inefficient to compare all available alternatives. Instead, when faced with an unfeasibly large choice set, some individuals may compare groups of alternatives (i.e. categories) to reduce the choice set into a more manageable set of relevant alternatives. I call these individuals *categorical considerers* and develop a model in which these decision makers sequentially apply a single well-behaved preference relation at different levels of aggregation. I explore the implications of this model for both individual behavior and equilibrium firm behavior in market settings. Under certain conditions, the existence of categorical considerers in a market causes firms to utilize strategies different from what would be optimal in a market of fully rational consumers. This simple model generates predictions about behavior consistent with several new field experiments, and offers possible explanations for excess spatial product differentiation, brand name premiums, and product branding.

The second chapter, written jointly with Mireille Jacobson, explores the question of what exactly not-for-profit hospitals maximize. While theories of not-for-profit hospital behavior abound, most are general statements of preferences and do not yield empirically testable (differentiable) predictions. To address this shortcoming we use a unified theoretical framework to model three popular theories of not-for profit hospital behavior: (1) "for-profits in disguise," (2) social welfare maximizers and (3) perquisite maximizers. We develop testable implications of a hospital's response to a fixed cost shock under each of these theories. We then examine the effect of a recent un-funded mandate in California that requires hospitals to retrofit or rebuild in order to comply with modern seismic safety standards. Since the majority of hospitals in

the State were built between 1940 and 1970, well before a sophisticated understanding of seismic safety, a hospital's compliance cost is plausibly exogenously predetermined by its underlying geologic risk. We present evidence that within counties seismic risk is uncorrelated with a host of hospital characteristics, including ownership type. We show that hospitals with higher seismic risk experience larger increases in the category of spending that should be affected by retrofitting and that hospitals facing higher compliance costs are more likely to shut down, irrespective of ownership type. In contrast, private not-for-profits alone increase their mix of profitable services such as neonatal intensive care days and MRI minutes. Government hospitals respond by decreasing the provision of charity care. As expected, for-profit hospitals do not change their service mix in response to this shock. These results are most consistent with the theory of not-for-profit hospitals as perquisite maximizers and allow us to reject two of the leading theories of not-for-profit hospital behavior - "for-profits in disguise" and "pure altruism." These results also imply that government owned hospitals have welfare as their maximand. More work is needed to determine the overall welfare implications of these different ownership structures.

The third chapter, written jointly with Antoinette Schoar, examines the impact of individual judges on the disposition and long run success of firms seeking Chapter 11 bankruptcy protection. Using case information on Chapter 11 filings for almost 5000 private companies across five district courts in the US between 1989 and 2004, we first establish that within districts cases are assigned randomly to judges, which allows us to estimate judge specific fixed effects in their Chapter 11 rulings. We find very strong and economically significant differences across judges in the propensity to grant or deny specific motions. Specifically some judges appear to rule persistently more favorably towards creditors or debtors. Based on the judge fixed effects we created an aggregate index to measure the pro-debtor (pro-creditor) friendliness of each judge. We show that a pro-debtor bias leads to increased rates of re-filing and firm shutdown as well as lower post-bankruptcy credit ratings and lower annual sales growth up to five years after the original bankruptcy filing.

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Chapter 1

Categorical Consideration: Theory and Market Implications

1.1 Introduction

A growing body of literature documents individual behaviors that are difficult to reconcile with standard models of rational choice. Some of the most compelling of these studies show dramatic changes in consumer behavior in response to changes in the decision-making environment that, according to the standard model, should be either unimportant or uninformative.[1] Similarly, a new but growing literature in Boundedly Rational Industrial Organization (BRIO) examines firm behavior difficult to reconcile with rational markets.[2]

In this paper, I present a model of discrete choice that serves to reconcile several established behavioral anomalies in a boundedly rational framework. This model is based on the idea that if product evaluation requires time and other cognitive costs, consumers may find it infeasible or undesirable to compare all available alternatives. When faced with an infeasibly large choice set, consumers utilize categorical

[1]See Simonson (1989), McFadden (1999), Iyengar & Lepper (2000), Boatwright & Nunes (2001), Poilaine (2006), and Chang, Mullainathan & Shafir (2008).

[2]For examples see Della Vigna & Malmendier (2004, 2005), Heidhues & Koszegi (2005, 2008), Eliaz and Spiegler (2006), Spiegler (2006a 2006b) and Mullainathan et al. (2008). Ellison (2006) also provides an excellent recent overview of the BRIO literature.

comparisons to quickly reduce the choice set into a more manageable set of relevant alternatives. I refer to this process as categorical consideration.

I show that this model reconciles several behavioral anomalies in a parsimonious, welfare preserving manner. In addition the model provides a micro-foundation for several empirical regularities in firm behavior, including excess product differentiation, premiums for physically identical products, certain types of pay-for-placement, and artificial product differentiation through branding.[3]

In my model, boundedly rational consumers sequentially apply a single well-behaved preference relation at different levels of aggregation. This model retains the assumption that consumers have stable preferences, but relaxes the assumption that they are applied simultaneously over all alternatives. Instead consumers first utilize categories to reduces the set of available alternatives to a smaller set of "relevant" alternatives, and then select their preferred alternative from this limited set. Borrowing a term from the marketing literature, I refer to this set of relevant alternatives as the consideration set.[4] The core of my model is the process by which consumers use categories to reduce the set of available alternatives into a consideration set. When faced with an infeasibly large number of alternatives, consumers first divide the alternatives into categories. Consumers then choose the preferred good from the alternatives in their preferred category.

For concreteness, imagine the decision process of an individual deciding where to go for dinner. In both the standard and categorical consideration models, the decision maker is assumed to have a stable system of preferences over attributes and knows (or has access to) the attributes of a large number of restaurants. In the standard model, a consumer would fully evaluate all available restaurants and select the utility-maximizing one. In contrast a categorical considerer first decides on the type of cuisine she wants (e.g. pizza, Chinese, seafood) and then chooses the utility maximizing restaurant from the subset of restaurants in her preferred category. The

[3]Real product differentiation refers to firms producing different product varieties, while 'artificial' product differentiation refers to a firm's use of branding to generate the appearance of increased variety (i.e. product that vary only in terms of non-informational labels).

[4]See Roberts and Lattin (1997) for an review of the marketing research on consideration sets.

main insight of categorical consideration is that when individuals use coarse partitions to eliminate a set of alternatives, individual choice can be affected by both the overall composition of the choice set (i.e. irrelevant alternatives) and how the choice set is partitioned (i.e. what categories an individual uses).

A categorical consumer's choice procedure then proceeds in two stages. First, if faced with "too large" a set of alternatives, individuals use ℓ to partition the set S into subsets $\{S_m\}$. In the first stage categorical consumers choose their preferred subset S_{m*} from $\{S_m\}$. Decision makers then proceed to the second stage in which they select their preferred object j^* from the consideration set $C \equiv S_{m*}$.

Put another way, for an alternative to be chosen not only must it be preferred to other alternatives in its category, but it's category must also be preferred to all other categories. That is, demand for a good j in S is jointly determined by the demand for good j relative to other goods in its category, as well as the demand for its category relative to the other categories in S.

Though categorical consideration retains the assumption that individuals have a single set of stable preferences over characteristic bundles, the sequential application of these preferences at different levels of aggregation generates choice behavior inconsistent with the standard model. Three implications of this process generate the non-classical behavior - *coarseness*, *limited consideration*, and *framing.*

In the first stage of categorical consideration, instead of separately evaluating all available alternatives, consumers sort alternatives into aggregations of similar objects. That there are fewer partitions than distinct alternatives is what I refer to as coarseness or categorical thinking.[5] Coarseness is then equivalent to a rational individual who is simply unable to distinguish between distinct alternatives within a category.

Limited consideration refers to the fact that individuals select their preferred alternative from alternatives in their consideration set. That is, they only seriously consider products in their preferred category. When the consideration set is the full

[5]This is a slight abuse of a term from Mullainathan (2000), where coarse thinking refers to a model of human inference in which instead of continuously updating their priors based on the Bayesian idea, people have only a finite number of priors or mental categories. In my model, coarseness refers to the idea that decision makers do not differentiate between the full set of alternatives, but instead make evaluations based on aggregations of alternatives (i.e. categories).

set of alternatives ($C = S$), the model is equivalent to the standard rational model. But when the consideration set is strictly smaller than the full set of alternatives ($C \subset S$), limited consideration can clearly lead to choice behavior different from the rational baseline.

Framing deals with the fact that a set of alternatives may be divisible or categorizable in more than one way. Since the effect of both coarseness and limited consideration depends on the specific categories used, the dimension by which S is subdivided into distinct categories is an important determinant of consumer choice over S. I refer to the specific subdivision as a "frame." Each distinct ℓ then specifies a particular frame in which categorical consideration takes place. For the remainder of the paper, *framing* or the *framing effect* refers to the overall impact of a particular ℓ on consumer choice.

In this paper, I largely limit myself to exogenously determined frames. A study of endogenous framing is an important area for future work. Following a brief literature review, the paper proceeds in four parts. In Section 2 I present the categorical consideration model and highlight some of the key implications of the model for consumer behavior.

In Section 3 I present the results of three recent field experiments that provide empirical support for the model. The first experiment focuses on the impact of coarseness on demand for a differentiated product (i.e. single serving lunch options at a local market). Consistent with my model, I find that putting a good on sale increases the sale of substitute goods in the same category as the sale item. I next show how standard methods for the structural estimation of discrete-choice models can be modified to account for the presence of some categorical consumers. Applying these methods to the data, I find that a model with some categorical consumers has better predictive power than the standard model. The second experiment highlights the impact of limited consideration. Specifically I find that mixing bottles of water that were previously in adjacent but separate coolers changes brand market share by a factor of 14. The third experiment examines the importance of frames of categories in determining choice. I find that providing consumers with informative labels categorizing jars of jam *decreases* aggregate demand across three bakeries.

In Section 4, I examine profit maximizing firm behavior in several market settings and show how equilibrium strategies are affected by the presence of some categorical consumers. I first show that in the presence of categorical consumers, a monopolist has an incentive to produce greater variety. Then in a sequential entry setting, I show that incumbents can credibly deter entry through pre-emptive investment in new goods (i.e. crowding the product space). Both these results suggest that the presence of categorical consumers can bias a market toward multi-product monopoly. In the third market application, I show how the presence of categorical consumers can explain how multi-product brands are able to maintain price premiums over physically identical generic goods. In the final market application I show how firms may be able to decrease competition by artificially differentiating their product through product branding.

Section 5 concludes.

1.1.1 Literature Review

The model presented in the paper is a synthesis of two different literatures on bounded rationality - the marketing literature on consideration sets and the literature in both psychology and economics on categorical thinking.

The marketing literature on consideration sets dates back to Miller (1956), and takes many of its cues from an even older psychology literature regarding the ability of consumers to evaluate a large number of alternatives. The basic ideas behind consideration sets are that in many real world settings, individuals are offered a myriad of alternatives and that because of either psychological constraints or cognitive costs, considering all the possible alternatives is either infeasible or inefficient. Consumers therefore seriously consider only a small set of alternatives, ignoring the rest.

The earliest literature tended to focus on demonstrating that, for various specifications of cognitive costs, the evaluation of all available alternatives is non-optimal.[6]

[6]Examples include Shugan (1980), Ratchford (1980), Roberts (1983), and Roberts & Lattin (1991).

More recently, the marketing literature has moved their focus to the implications of consideration sets on aggregate behavior (Hauser and Wernerfelt 1990) and on consideration set formation itself (Tversky & Sattath 1979, Chakravarti & Janiszewski 2003). For example, in Roberts and Lattin (1991), the authors find a closed form solution for the number of "brands" an individual would consider as a function of evaluation costs and expected distribution of utilities for brands. Chakravarti and Janiszewski (2003) model consumers as constructing consideration sets by including products that are highly "alignable" or have a high number of overlapping features.

The concept of categorical thinking - that decision makers process information with the aid of categories - dates back to the social psychology literature of the 1950s.[7] Most often applied in the context of stereotypes, social psychologists have generated a significant body of work demonstrating the important role categories play in individual decision making. In linguistics the idea of a type of categorical thinking is implicitly the basis for the debate of whether or not structural variation in language lead to qualitative spatial variation in perception, or more simply stated whether language impacts how individuals perceive the world around them.[8]

More recently, economists have looked to categorical thinking as a means of understanding choice behavior. Mullainathan (2002) and Fryer & Jackson (2007) present models of human inference where decision makers have fewer mental categories than actual varieties, and explore how such categorization affects decision making. Mullainathan et al. (2008) explores how such thinking can be exploited by persuaders to shed light on how uninformative messages can affect beliefs. Of a more theoretical bent, Ellison & Holden (2008) examine a model with endogenously coarse rules and Peski (2007) presents a model of sequential learning in which, under certain conditions, dividing objects into categories with similar properties is part of an optimal solution. My model is very much in the general spirit of this more recent literature, and can be thought of as a consideration set model of choice where consideration sets

[7] Ashby & Maddox (1993), Reed 1972, Roscho 1978, Rosseel 2002, Brewer 1998, Bruner 1957, Macrae & Bodenhausen (2000), Lepore & Brown (1997), Kreiger (1995), Bargh (1999), Quinn & Eimas (1996).

[8] See for example Hayward & Tarr (1994).

are formed through categorical thinking.

The main difference between models like Mullainathan et al. (2008) and the one presented here is the role of uncertainty. In Mullainathan et al. (2008), coarse thinking causes individuals to make incorrect inferences about an alternative. In categorical consideration, coarse thinking leads individuals to make errors by not considering the optimal alternative. One important implication of this difference is that while mistaken inference will cause an individual to regret purchasing an alternative in an absolute sense, a categorical consideration will only regret purchasing an alternative relative to purchasing some unconsidered but superior alternative.

My model of categoric consideration is also closely related to the choice-theoretic literature on sequential decision making. Since categorical designation is based on product attributes, the first stage of categorical decision making has clear similarities with the *Elimination by Aspects* theory of choice (Tversky (1972)). In terms of two stage decision processes, Mariotti and Manzini (2008) present a model of *Sequentially Rationalizable Choice* called the *Rational Shortlist Method* (RSM) in which consumers first reduces the set of alternatives into a *shortlist.* Masatlioglu and Nakajima (2008) present a general framework of *Iterative Search.* According to iterative search, for each good there are a set of "relevant" alternatives, and consumers iterate through a path-dependent set of consideration sets to decide on an alternative. Eliaz and Spiegler (2007) present an implementation of iterative search and explore the implications of their model on competition between two firms.

This paper also contributes to the growing body of work in boundedly rational industrial organization. This relatively recent but fast growing body of literature studies firm behavior in the face of consumers who exhibit behavior that is boundedly rational along some dimension.[9] Particularly relevant to this paper is work by Shapiro (2006), Mullainathan et al. (2008), Carpenter et al. (1994), and Eliaz and Spiegler (2007), who explore ways in which non-informational advertising can influence the behavior of boundedly rational consumers.

[9]Examples include DellaVigna & Malmendier (2004, 2005), Ellison (2005), Gabaix & Laibson (2006), Heidhues & Koszegi (2005, 2008), Rubinstein (2003), Schlag (2004), Spiegler (2004, 2006).

Although my model shares many of the features of this choice-theoretic literature, there are several key differences. First while individuals sequentially apply a binary preference relation, only one preference relation is needed. That is, instead of sequentially applying two asymmetric binary relations (the first of which may or may not correspond to a well behaved preference relation), in my model individuals utilize a single standard preference relation at different levels of aggregation. More significantly, unlike the iterative search models, the model presented here does not rely on a pre-determined starting good (or set of goods) to generate consideration sets.[10] Since the predictions of an iterative search model with endogenous reference points depend importantly on a parameter generated by a process outside the scope of the model itself, falsification is necessarily more difficult. In addition since the only restriction on consideration sets is that it includes the reference product, iterative search requires the econometrician to observe the *actual consideration sets* used by individuals to identify preferences.

1.2 Consumer Behavior

1.2.1 The Basic Model

Let S be a non-empty finite set of mutually exclusive alternatives indexed by j and where each alternative can be treated as a bundle of K characteristics; that is we assume that a product j can be fully characterized by a vector $x_j \in X$ where X is a K-dimensional Euclidean space and a price $p_j \in \Re$.

A *frame* is a partitioning of characteristic space X as defined by ℓ. Then any two alternatives j and j' whose characteristic vectors x_j and $x_{j'}$ occupy the same partition in X are grouped together. That is, categories are defined as alternatives with characteristic vectors in a subspace $x^k \in X_m \subset X$. Product partitions or categories are indexed by $m = 1, 2, \dots, M$ and denoted by S_m. The elements of S_m are denoted as j_m and indexed from 1 to J_m.

[10] In these models, the endogenous starting point is usually discussed in terms of a default or status quo option.

Consumers are indexed by i and characterized by types $\theta_i \in \Theta$. Consumers have unit demand for at most one good and always have an outside option $S_0 = \{j_0\}$. For an individual of type θ, her preference over attribute bundles is then given by a function f_θ that maps a vector $x \in X$ to a point on the real line, $f : X \mapsto \Re$. Her utility for a given instance of an attribute bundle is given by a sum of her preferences over attribute bundles and a probabilistic term $\eta_{j,\theta}$. The utility of a user of type θ_i if she purchases good j can then be written as

$$u_i(j, p_j) = f_{\theta_i}(x_j, p) + \eta_{j,\theta_i}. \tag{1.1}$$

The utility an individual derives from an alternative j is jointly determined by a function of its characteristics x_j and a stochastic term η_j. Let S be a set of J alternatives indexed by j. Assuming η takes on discrete values, the expected value of good j is

$$E(u_\theta(j)) = \sum_{\eta_{j,\theta_i}} Pr(\eta_{j,\theta} = \eta)[f_\theta(x_j, p) + \eta_{j,\theta}] = f_\theta(x_j, p) + E(\eta_j|\theta_i).^{11} \tag{1.2}$$

Since a consumer can choose only a single alternative, the utility a consumer can extract from a set of alternatives S is equivalent to the highest utility provided by any single alternative in S. Specifically, the utility a consumer of type θ_i can extract from set S is given by

$$U_i(S) = Max\{u_{\theta_i}(j, p_j)\} \quad \forall j \in S. \tag{1.3}$$

Since utility has a stochastic component, the value of $U_\theta(S)$ depends on the specific

[11] Similarly when η is continuous, the analogous identity is $E(u_\theta(j)) = \int_{\eta_{j,\theta_i}} d\eta h(\eta)[f_\theta(x_j, p) + \eta] = f_\theta(x_j, p) + \int_{\eta_{j,\theta_i}} d\eta h(\eta)\eta_{j,\theta_i} = f_\theta(x_j, p) + E(\eta|\theta_i)$ where $h(\eta)$ is the probability distribution function for η_{j,θ_i}.

realization(s) of η_{j,θ_i}. Let Z be a set indexed by z that corresponds to the set of all possible values of $U_\theta(S)$, and σ_z be the probability that $U_i(S) = U_{i,z}$. Then before learning the stochastic component of products' utility, a consumer of type θ_i has expected utility from set S given by

$$E(U_i(S_m) = \sum_Z \sigma_z U_{i,z}. \tag{1.4}$$

Categorical consideration then proceeds as follows: A consumer uses ℓ to partition a set of alternatives S into categories S_m and chooses the category S_m^* with the highest expected utility. I refer to this preferred category of alternatives as the consideration set and denote it by C. The consumer then examines the products in her consideration set (i.e. learns the value of the stochastic component of utility) and chooses the utility maximizing alternative $j \in C$ which I denote as j^*.

Note that in the special case where $C = S$ (i.e. S is partitioned into a single set containing all available alternatives), the model is equivalent to the standard model of rational choice. Deviations from the standard model occur when S is partitioned into multiple categories.

Consider the following example, where consumers use a single ℓ to partition S into multiple categories, each of which contains more than one alternative j. Categorical consideration is then captured by a two step process in which consumer i first selects the category that maximizes her expected utility ($C \in \{S_m\}$), and then chooses the utility maximizing alternative ($j_m \in C$).

The probability that a product $j' \in S_m$ is the preferred good is then given by the joint probability $Pr(j' = j^*) = Pr(u(j') > u(-j')) * Pr(U(S_m) > U(S_{-m}))$. That is, for good j to be the chosen good, it must be both the preferred good in its category and belong to the preferred category.

For any alternative $j' \in S_m$ the characteristics of the other alternatives $-j \in S_m$ will impact the probability of it being chosen in two ways. In a slight abuse of the notation, we note that $\frac{\partial}{\partial u(-j')} Pr(u(j') > u(-j')) \leq 0$. That is, according to the first term, the probability that j is the preferred good decreases in the utility of other goods in the set S_m. This term is just the result of the standard substitution effect among the goods $j \in S_m$. But because consumers select their preferred good from only among the alternatives in their consideration set C, the probability that the good is *considered* at all is increasing in the utility of the other goods in its category S_m. This effect is captured by the second term for which $\frac{\partial}{\partial u(-j')} Pr(u(S_m) > u(S_{-m})) > 0$. That is, the probability of a good j being chosen *increases* in the utility of other goods in set S_m.

Interpreting $\eta_{i,j}$

The stochastic element $\eta_{i,j}$ plays a crucial role in generating non-rational behavior. In the special case where $\eta_{i,j} = k_i \; \forall j$, the model reduces to the rational model. As such, understanding the role of uncertainty can provide guidance as to where we would expect to see significant departures from rationality. Specifically, we would expect significant departures from rationality only when some aspect of product utility is uncertain.

Interpretation of the uncertainty introduced by $\eta_{i,j}$ can perhaps be best understood in relation to the well known Random Utility Model (RUM). In both the RUM and Categorical Consideration Model (CCM), for a given consumer of type θ_i, the utility of an alternative j is assumed to be jointly determined function of its characteristics x_j and the attributes of the consumer: $u_i(j) = f(x_j, \theta_i)$. In the RUM the stochastic component of consumer utility is due to product characteristics unobservable to the econometrician. That is, although individual consumers costlessly observe all product characteristics x_j and behave deterministically, the econometrician observes only a strict subset of a product's characteristics. The stochastic component $\eta_{i,j}$ simply compensates for the econometrician's inability to observe all the relevant parameters, and has no impact on an individual's choice. For individual, decisions are fully deterministic and only appear probabilistic to the econometrician because of unobservables.

In contrast, under CCM, individuals costlessly observe only a subset $\tilde{x}_j$ of product characteristics, and have some beliefs on the values of the remaining product characteristics $\hat{x}_j$. Consumers can learn values of the characteristics $\hat{x}_j$. But because such learning is costly, when faced with a large number of alternatives, consumers are unwilling to evaluate them all individually. Instead they use the costlessly observable characteristic and their beliefs about the unobserved product characteristics to reduce the set to a smaller number of highly relevant alternatives to evaluate.

Consider a consumer shopping for a car. According to RUM, consumers costlessly observe all product characteristics and can therefore determine the utility each car would provide. A consumer then simply chooses the car that provides the utility from the full set of available automobiles. According to CCM, consumers costlessly observe only some product characteristics and have (correct) beliefs regarding the distribution of the remaining product characteristics. Consumers then decide based on the observable characteristics and beliefs which cars to investigate further (e.g. test drive) in order to learn the previously unobserved product characteristics to determine a car's actual utility.

As a second example, consider the decision process of a consumer presented with a display free sample display for an unfamiliar brand of jam. Although the consumer may have well defined preferences over jam flavors (e.g. she prefers strawberry to grape), she may still face some uncertainty regarding her preferences over these specific jams - an uncertainty that can be resolved by taking a free sample.

According to CCM, when faced with such a display, a consumer will look over all the available alternatives (flavors) and categorize then according to some criteria (e.g. jams or jellies, berry or citrus). The consumer then chooses her preferred category and tastes only the jams in that category (i.e. consideration set). She purchases one of the tasted jams if she likes it well enough.[12]

[12]The prediction that consumers fully evaluate only a subset of available items is supported by data from the jam tasting booth experiment in Iyengar and Lepper (2000). Though not the main thrust of their analysis, one striking result of their experiment is that even when faced with as many as 24 different jams, individuals tasted on average only slightly more than two samples.

1.2.2 Implications of the Model

Under categorical consideration, bounded rationality manifests in two ways: limited consideration and coarse thinking. Simply stated limited consideration says that a decision maker does not necessarily choose from amongst the full set of available alternatives. That is, in the presence of *limited consideration*, a decision maker might select an alternative that would not have been chosen if she had evaluated all available alternatives. Coarse or categorical thinking says that the decision maker might not treat all alternatives as distinct, but instead uses coarser partitions in which several alternatives are placed into a single partition or category. A specific set of categories used to partition a set of goods is referred to as a frame. These two factors combine to generate a range of behavioral anomalies consistent with a range of both empirical studies of individual choice behavior and observed firm strategies.

Choice behavior under categorical consideration need not satisfy the Weak Axiom of Revealed Choice (WARP) or equivalently the Axiom of Independence of Irrelevant Alternatives (IIA). This violation can arise one of two ways. First, because of coarseness, whether or not a good is even considered is a function of the other goods in its category. Second, if a product's classification (i.e. ℓ) is endogenously determined, an irrelevant alternative could affect the categories themselves.

As a simple example assume that a consumer uses a single frame to partition goods such that alternatives $\{A, B, C\}$ correspond to categories $S_1 = \{A\}$ and $S_2 = \{B, C\}$. Let $A \succ> C \succ B \succ 0)$ and $\{B, C\} \succ\{ A\} \succ 0$. Consider the the behavior of a categorical consumer when presented with $S = \{A, B, C\}$ or $S' = \{A, C\}$.

If $S = \{A, B, C\}$, in the first stage the consumer compares product $S_1 = \{A\}$ to $S_2 = \{B, C\}$. Then since $\{B, C\} \succ\{ A\} \succ 0$, the consumer will choose $S_2 = \{B, C\}$ as her consideration set. And since $C \succ B \succ 0$, the consumer will choose alternative C. If instead $S' = \{A, C\}$, the consumer first compares $S_1 = \{A\}$ and $S_2 = \{C\}$. $\{A\} \succ \{C\} \succ 0$ so the consumer's consideration set is $S_2 = \{A\}$, and since $A \succ 0$ the consumer will choose alternative A.

Unlike many characterizations of violations of WARP, the change in choice does not arise from inconsistent preferences, but rather as a result of the sequential application of a single, well behaved preference relation at different levels of aggregation. That is, categorical consideration is a procedurally rational attempt to approximate fully rational choice behavior.

When consumers are categorical, "irrelevant" alternatives affect decision making through coarseness. In terms of utility, the condition that a products utility depends only on its own characteristics and not that of other goods is sufficient to guarantee IIA. But in categorical consideration, coarse thinking alternatives are not seen as distinct entities but instead share the characteristics of the alternatives in the category. Therefore, though categorical consideration does not always satisfy IIA, it specifies a (restrictive) mechanism through which these violations are generated.

The following axioms illustrate some of the implications of these restrictions.

Axiom 1 *Very Weak Axiom of Revealed Preference (VWARP): For any finite set of mutually exclusive options S, if a decision maker chooses j^{m*} in partition $S_m \subset S$, then no $j \in S_m \neq j^{m*}$ will ever be the chosen good for any possible partitioning of S if its partition includes j^{m*}.*

This axiom arises from the fact that *within* categories, preference rankings of goods are stable. That is, if a good is preferred to another good, it will always be preferred to the other good if they are in the same category, regardless of how categories are partitioned. An alternative specification of VWARP is that for a fixed set of partitions $\{S_m\}$, the selected alternative is limited to the set $\{j^{m*}\}$. The alternative chosen by a categorical considerer must be the best in a given category. Note that this means that although a consumer may purchase a good that is strictly dominated by another available alternative, categorical consideration will never lead a consumer to mistakenly purchase a good that did not provide some consumer surplus.

Axiom 2 *Weak Axiom of Revealed Categorical-Preference (WARC): Let $\{S_m\}$ define a finite partition of a set of mutually exclusive options S. If category $S_x \succ S_y$ given $\{S_m\}$, then $S_x \succ S_y$ given $\{S_m, S_k\}$ for all S_k.*

This axiom arises from the fact that consumer preferences are stable *across* categories. In other words, at every stage of decision making, a categorical considerer acts rationally. That is, for any given set of sets, the WARP holds. Violations from the standard model are then the result of the fact that individual preference relations are applied on different levels of aggregation.

Axiom 3 *Best is Best: Let u generate a cardinal measure of preference for alternatives $j \in S$ and let u^* correspond to the highest utility of a good in set S. For any set of goods S, there exists a good j^b with $u^b > \bar{u}$ such that good j^b will be chosen regardless of how S is partitioned.*

This axiom states that for any given set S, if a product is good enough, it will be selected regardless of categorization. That is, if a product is "better enough," consumer choice is invariant to bounded rationality. Though this result may seem somewhat trivial, many models of limited consideration do not satisfy this axiom. For example, in both the classic consideration set model from marketing and the iterative search model, since product utility is not necessarily used to generate the consideration set, a good need not be considered regardless of how much better it is than the considered alternatives. Put anther way, a fundamental property of most models of limited consideration is that consumers essentially choose a local maxima (i.e. best good in a category). Under categorical consideration, since the choice of consideration set (i.e. best category) is based in part on the value of the best in class alternative, the decision maker will always choose the global maxima if it represents a sufficiently large enough improvement over all other local maxima.

1.3 Empirical Examples

The following three empirical examples serve the dual purpose of grounding behind categorical consideration in real world situations and providing empirical evidence in support of the model. The first example explores consumer behavior when a good j is replaced by a strictly superior good j' for a fixed set of categories. Specifically I examine aggregate demand behavior when the price of a single good is reduced. I then show how to modify the standard structural econometric methods to account for the presence of some categorical consumers. In the second example both the categories and product set are fixed, but a good j is moved from one category to another. In the final example, I examine demand when consumers use different categories to partition a fixed set of products.

1.3.1 Example 1: Fixed Category Sales

In standard demand models, in the absence of complementarities and income effects (e.g. discrete choice models commonly used in Industrial Organization), replacing a good with a more attractive alternative cannot increase the demand for other goods. In contrast, in the categorical consideration model, replacing a good with a more attractive alternative can increase the demand for other (substitute) goods.

Consider the following field experiment:[13] A retail store sells a variety of fresh single-serving lunch options to a mostly weekday work crowd. These options include approximately ten cold salads and ten "heat-and-eat" entrees located together in a large cooler. All items are made daily and have the date of manufacture clearly located on the product label. As part of the experiment, we exogenously placed one of the salads on sale.[14] Since products expire relatively quickly and are meant to serve as complete self contained meals, this set-up avoids two of the most common concerns of discrete choice models: product stockpiling and product mixing.

I model consumer choice in this environment in a discrete choice framework (i.e. consumers purchase at most one good). In terms of categorical consideration, I assume boundedly rational consumers partition the goods into the two categories: salads and entrees. The specific mix of lunch options change daily depending on supply shocks (e.g. the store receives a shipment of cheap salmon).

Consider aggregate consumer demand when a single salad is put on sale. In the standard discrete choice framework with rational consumers, decreasing the price of

[13] See Chang et al. (2008) for a more detailed treatment of the experimental setup.

[14] The base price for the salad was \$5.49 and the price reduction was \$0.50.

Table 1-I
Salad Experiment Results[15]

	Sale Salad	*Other Salads*
Sale Treatment	1.31	2.06
	(0.25)	(0.32)
Constant	6.97	8.95
R-squared	0.54	0.19

an alternative affects demand only through a substitution effect.

If consumers are instead categorical, lowering the price of a good has two effects. First, as in the rational model, the substitution effect decreases the demand for other non-sale goods in the sale good's category (i.e. non-sale salads). In addition, under categorical consideration, the coarseness effect predicts that decreasing the price of a good increases the attractiveness of the sale goods category. This second effect leads to an increase in the number of consumers who choose salads as their consideration set. In terms of the demand for non-sale salads, coarseness acts as a countervailing force to the usual substitution effect, and can even lead to an increase in demand for non-sale salads.

Table 1-I reports the sales of salad on sale and non-sale days. The first two columns of Table 1-I report the sales of the sale item under the sale and no sale condition. As predicted by both models, reducing the price of a salad increases demand for the good. The second two columns of Table 1-I report the sales of non-sale salads under the sale and no-sale condition. Inconsistent with rational choice, putting a salad on sale significantly increases the sales of non-sale salads.

[15]Notes: Standard errors are in parenthesis. The regression includes both week and day-of-week fixed effects.

Estimation

Since categorical consideration is based on a single well behaved preference relation operating in a restrictive framework, welfare analysis and counterfactual generation is possible using standard techniques on commonly available datasets.

To wit, consider the following example of an implementation of categorical consideration in a random utility framework. Let ζ_i and w_j represents the attributes of person i and characteristics of product j respectively. Assuming the conditional utility for individual i from product j is a function of individual attributes (i.e. type), ζ_i and product characteristics w_j we can write individual utility as

$$u_{i,j} = g(\zeta_i, w_j) + \epsilon_{ij}, \tag{1.5}$$

where ϵ_{ij} is a mean-zero stochastic term.

Let the probability of a tie be zero. Presented with alternatives S, a rational consumer i will choose good j if and only if

$$u_{i,j} \geq u_{i,j'}, \quad \forall j' \in S. \tag{1.6}$$

By comparison, when presented with alternatives S, a categorical consumer will choose good j if and only if

$$u_{i,j} \geq u_{i,j'}, \quad \forall j' \in S_m, \tag{1.7}$$

and

$$U_{i,S_m} \geq U_{i,S'_m}, \quad \forall S'_m \in M, \tag{1.8}$$

where S_m are partitions of S (i.e. categories): $M \equiv \{S_1, \ldots, S_M\} = S$. That is, a categorical consumer of type ζ will choose good j if and only if it is both the utility maximizing good in its category, *and* belongs to the expected utility maximizing category.

The set A_j, as defined by

$$A_j = \{\zeta : u_{i,j}(\zeta_i; B) \geq u_{i,j'}(\zeta_i; B),\ \forall j' \in S\}, \tag{1.9}$$

is the set of rational consumer types (i.e. values of ζ) who choose good j.

Similary the set $\tilde{A}_j$, given by

$$\begin{aligned} \tilde{A}_j = \{\zeta : u_{i,j}(\zeta_i; B) \geq u_{i,j'}(\zeta_i; B),\ \forall j' \in S \\ \&\ \ U_{i,S_m}(\zeta_i; B) \geq U_{i,S'_m}(\zeta_i; B),\ \forall S'_m \in M\}. \end{aligned} \tag{1.10}$$

is the set of consumer types who, if categorical, will choose good j.

Consider now a population consisting of a fraction λ categorical consumers and a fraction $(1-\lambda)$ rational consumers, and let $f(\zeta)$ describe the density of consumer types in both sub-populations. Then the market share of good j is given by

$$\begin{aligned} s_j(x; B) &= \lambda s_j^c(x; B) + (1-\lambda) s_j^r(x; B) \\ &= \lambda \int_{\zeta \in \tilde{A}_j} f(\zeta) d\zeta + (1-\lambda) \int_{\zeta \in A_j} f(\zeta) d\zeta. \end{aligned} \tag{1.11}$$

Although this expression does not, in general, have a closed form solution, it is amenable to the usual simulation assisted estimation techniques (e.g. Maximum Simulated Likelihood (SML), Method of Simulated Moments (MSM), or Method of Simulated Score (MSS)).[16] As such the only additional burden categorical consideration places on estimation is knowing the frame ℓ used by categorical consumers in a market (i.e. how the consumer partitions a set of goods).

Since the rational model corresponds a restricted version of the mixed model (i.e. $\lambda = 0$), one can use a simulated likelihood ratio test to directly test the full rationality restriction.

[16]For an excellent and comprehensive treatment of simulation assisted estimation in a discrete choice setting, see Train (2003).

Consider then the following implementation of a very simple linear random-coefficient model when consumers partition goods into salads and non-salads. Consumer utility from purchasing good j can then be written as

$$u_{i,j,t} = \beta_{i,j} D_j - \alpha_i p_{j,t} + \epsilon_{i,j,t}, \tag{1.12}$$

where D_j are product dummies, p_j is the price of good j in market (i.e. day) t, $\epsilon_{i,j,t}$ is an independent and identically distributed extreme value (i.e. Gumbel distribution), and $(\alpha_i, \beta_{i,j})$ are individual specific coefficients.

Due to data limitations, I examine the sales of only the 5 main treatment salads indexed as $j = 1, \dots, 5$, and let $j = 0$ represent all non-salad lunch item. I further assume $\alpha_i = \alpha$ and $\beta_{i,j} = \beta_j \ \forall \ j \in \{1, 2, 3, 4, 5\}$, $\beta_{i,0} = \beta_0 + \nu_i$, $\nu_i \sim N(0, \sigma)$.[17]

Since the pricing variation was randomized across days, no instruments are needed. Normalizing the mean utility of the outside good to zero, the share of good j takes on the form

$$s_{i,j,t} = \lambda\left[\frac{e^{\delta_{i,j,t}}}{\sum_{j'=1,\dots,5} e^{\delta_{i,j,t}}}\left(1 - \frac{e^{\delta_{i,0,t}}}{\sum_{j'=0,\dots,5} e^{\delta_{i,j,t}}}\right)\right] + (1-\lambda)\frac{e^{\delta_{i,j,t}}}{\sum_{j'=0,\dots,5} e^{\delta_{i,j,t}}}. \tag{1.13}$$

where $\delta_{i,j,t} = \beta_{i,j} D_j - \alpha p_{j,t}$.

MSM estimates for both the unrestricted and restricted (i.e. rational $\lambda = 1$) cases are presented in Table 1-II. Unsurprisingly, given the relatively small ratio of observations to parameters, none of the parameters are significant under either specification. But importantly, even with the relatively poor fit, the (simulated) likelihood ratio test reject the rational model ($H_0 : \lambda = 0$), in favor of the categorical model, at the 0.1 percent level.

[17]This specification has the alternate interpretation that consumers are homogeneous, but the value of the outside option varies across days.

[18]Notes: 95% confidence interval are in parenthesis. The sample consisted of 140 observations over the course of 28 days. Treatments across days were randomized using incomplete latin squares.

Table 1-II
Salad Experiment Results II[18]

	Restricted ($\lambda = 0$)		Unrestricted	
α	0.3321	(-0.3630, 1.0273)	0.4029	(-0.3203, 1.1260)
Salad 1	1.6064	(-3.1984, 6.4112)	0.6669	(-7.6602, 8.9941)
Salad 2	1.9435	(-3.5577, 7.4447)	1.0522	(-7.9772, 10.081)
Salad 3	1.5255	(-3.2102, 6.2612)	0.5205	(-7.7316, 8.7726)
Salad 4	1.2231	(-2.1319, 4.5782)	0.1184	(-6.7530, 6.9898)
Salad 5	2.4761	(-2.1774, 7.1296)	1.4613	(-6.7036, 9.6261)
σ	0.0534	(-0.4048, 0.5115)	0.1437	(-0.4536, 0.1661)
λ	N/A	N/A	0.8990	(-6.8708, 8.6689)

1.3.2 Example 2: Switching a Product's Category

Consider then the results from the "Same cooler, different cooler" experiment from Chang, Mullainathan & Shafir (2008). The experiment involved moving a product from one cooler to an adjacent one. The experiment was run over the course of four days in a Boston area convenience store. This particular store had one large cooler with multiple "branded" doors (i.e. access to a single large cooler was provided by multiple glass doors, and behind each door were beverages from a single manufacturer). One of these coolers was branded by Poland Springs and contained various sized bottles of the brand's drinking water. Adjacent to this was a cooler branded by Pepsi that contained a variety of Pepsi products (mostly soda's), including a 20oz bottle of Aquafina brand drinking water. A 20oz bottle of Aquafina was approximately 10% cheaper than an equivalent bottle of Poland Springs. Since the doors had glass fronts, all the products were visible with the doors closed. When the two brands of bottled water were in different coolers, the 20oz bottle of Poland Springs outsold the 20oz version of Aquafina by a factor of seven. When the two brands of 20oz drinking water were mixed in both coolers, Aquafina became the dominant brand outselling Poland springs by almost a factor of two.[19]

Though these results are clearly difficult to reconcile with neoclassical demand,

[19]This factor of 2 is likely a lower bound since during one of the mixed periods, demand for Aquafina was so high as to generate a stockout during one of the treatment days.

they are fully consistent with categorical consideration. Specifically, when the two brands of bottled water were in separate coolers, even though the two different brands of 20oz drinking water are close substitutes, they need not display much cross-price elasticity. But when they were in the same cooler (category), we'd expect a high level of cross-price elasticity. Insofar as they are equivalent goods (i.e. conditional on price, they provide equivalent utility), we would expect to see a large shift from Poland Springs to the slightly cheaper Aquafina.

It is important to note that the cooler location *does not* provide a categorical considerer with any objectively useful information unavailable to rational consumers. That is, just like a neoclassical consumer, a categorical considerer does not believe cooler location in and of itself impacts the utility of a good (i.e. it is an informationless label). Rather it impacts choice because the label "cooler" is used by a categorical considerer as a type of organizational or bookkeeping device to determine product categories.

1.3.3 Example 3: Changing Frames

If a product attribute x does not impact utility (i.e. $\frac{du}{dx} = 0$), I refer to it as a label. Since labels, by definition, have no impact on utility, demand is unaffected by non-informational labels under standard rational choice.

A second common variant of informationless labeling is what I refer to as *redundant labels*, or those labels that correspond to an already observable product attribute. Examples include the packaging of some sugar based candies that declare their contents as having "low fat"[20], car dealerships writing descriptive phrases like "fuel efficient"[21], or EnergyStar certification for appliances.[22]

[20]As is currently the case for Twizzlers, York Peppermint Pattie, Jolly Ranchers, Good & Plenty, and Hershey's Chocolate Syrup.

[21]FTC regulation requires that all new and used cars sold in the US have prominent "window stickers" (a.k.a. a Monroney) that include numerical EPA fuel economy estimates, labeling a car as "fuel efficient" is redundant.

[22]U.S. Federal law (administered by the U.S. Department of Energy) requires appliances have a prominent *EnergyGuide Label* that provides estimated numeric operating costs/electricity use in comparison to similar models. *EnergyStar* is a more recent program jointly administered by the U.S. Department of Energy and the U.S. Environmental Protection Agency that allows firms to place an "Energy Star logo" on an appliance if the appliance meets a certain level of efficiency compared to

It is important to note that conditional on a frame ℓ, choice will vary if and only if the actual underlying distribution of utility changes. As in the rational model, conditional on ℓ, branding, non-informational labeling, and other marketing devices that do not directly impact product utility will not affect decision making.

Similar to the rational model, when product partitions are fixed, categorical demand is unaffected by non-informational labels. But to the extent that labels can affect the categories a consumer uses, labels can generate a change in product demand. One prediction of categorical consideration is that non-informational labels can impact consumer choice by changing how individuals partitions a set of goods.

An example of this type of behavior is found in Poilane (2007). Poilane ran a series of field experiments in three upscale bakeries. In the experiments she alternated between three different labeling conditions for a set of 12 jams. In one condition jams were presented without labels. In the second treatment jams were organized into three groups of four, with each group getting a descriptive category name (citrus, berry, nutty). In the final treatment, the descriptive labels were replaced with randomly assigned names ("the baker", "the pastry chef", "the apprentice"). Table 1-III presents the average weekly jam sales under each treatment condition.

Although product sales are not affected by the use of random category names, the use of descriptive category names significantly *decreased* total sales. For comparison, the magnitude of this decrease was on par with reducing the set of available jams by half.[24] The observed behavior is clearly inconsistent with the predictions of rational model under which the use of non-informative or redundant labels should not affect demand. In addition, insofar as redundant labels decrease search costs, this result is inconsistent with rational search cost models which would predict weakly increased demand under the descriptive label treatment.[25]

The observed behavior is however consistent with categorical consideration. Specif-

similar models *based on the EnergyGuide ratings.*

[23]Notes: Standard errors are in parenthesis. The regression store fixed effects. Treatments were randomized according to an incomplete latin square design.

[24]See Poilane (2007).

[25]In point of fact the original goal of the experiment was to see if the use of descriptive category labels could increase sales by decreasing consumer search costs.

Table 1-III
Jam Experiment Results[23]

	Tot Sales	*Log(Tot Sales)*
T1 - Descriptive	-5.64	-0.41
	(3.29)	(0.22)
T2 - Nonsense	1.05	0.06
	(3.75)	(0.19)
T3 - 6 jams	-4.49	-0.53
	(3.86)	(0.31)
Constant	18.18	2.80
R-squared	0.10	0.14

ically when faced with completely nonsensical labels, consumers ignore them and partition jams as they would in the absence of labels. When faced with a sensible categorization (i.e. the descriptive label condition), consumers may choose to partition jams in accordance with the presented labels. In the first case, since both the choice set and the partitions are the same, the categorical consideration model would predict no change in demand. In contrast, in the second case, since consumers change partitions, even though the choice set is unchanged, categorical consideration would predict some change in demand.

1.4 Firm Behavior

In the following section I examine firm behavior in a market with categorical considerers. In the first application, I examine optimal monopoly pricing with horizontally differentiated goods. I find that when consumers are categorical, a firm has higher incentives to produce additional product varieties. In addition, when faced with a potential entrant, I find that an incumbent can credibly deter entry by crowding the product space. Both these results imply that categorical consideration predisposes a market to a differentiated monopoly outcome.

I next examine competition between branded and generic goods in a horizontally differentiated market. Specifically I examine optimal pricing for a single product regional brand competing with a multi-product national brand. The main result is that when consumers are categorical, there can exist a wedge between the price of two identical items. That is, when consumers are boundedly rational, the insurance effect of having a larger product line allows the national brand to charge a higher price than a physically identical generic.

In the final application I examine how, in the presence of categorical consumers, a firm can increase differentiation through branding. Specifically when consumers think coarsely about brands, a firm's strategy of selling their products under multiple brands (even if brand is an uninformative label) may be optimal.

1.4.1 Product Proliferation

Consider the following variation of the basic model in Section 3 with horizontal product differentiation. There is a single firm that sells horizontally differentiated goods L and R at prices p_L and p_R. The firm can produce either good at constant marginal costs c_j and fixed cost F.

There is a measure one of homogeneous consumers. For consumer i the stochastic element η_i can take on values $\{0, 1\}$ where the probability that $\eta = 1$ is given by σ: $Pr(\eta_i = 1) = \sigma$. The interpretation here is that consumers have a preference for one of the two varieties, but initially have only a (correct) belief as to which good that will be. In addition to goods $\{L, R\}$, there is a third option M which provides consumers with utility $v' < v$. Consumer wish to purchase at most one of the products and receives zero utility from purchasing nothing. Consumer utility from product $j \in \{L, R, M\}$ is then given by

$$u_i(j, p_j; \eta_i) = \begin{cases} v - t(1-\eta_i) - p_L & \text{if } j = L \\ v - t\eta_i - p_R & \text{if } j = R \\ v' & \text{if } j = j = M \end{cases} \tag{1.14}$$

A fraction λ of all consumers are categorical considerers who partition the products $\{L, R\}$ separately from M: if faced with the choice set $S = \{L, R, M\}$, a categorical considerer will partition the set into the categories $S_1 = \{L, R\}$ and $S_0 = \{M\}$. For example consider an individual choosing between two types of soup or a salad for lunch or deciding whether to go out to one of two currently playing action movies or staying home to watch a favorite TV show.

For simplicity consider the case where $t > v$ so that for non-negative prices there is at most one good from the set $\{L, R\}$ that provides the consumer with non-negative surplus. Then for $p_j \leq v \; \forall j$, categorical consumer's expected utility for a set of goods S_m is

$$u(S_m, p_j; \sigma) = \begin{cases} \sigma[v - p_L] + (1-\sigma)[v - p_R] & \text{if } S_m = \{L, R\} \\ \sigma[v - p_L] & \text{if } S_m = \{L\} \\ (1-\sigma)[v - p_R] & \text{if } S_m = \{R\} \\ v' & \text{if } S_m = \{M\} \end{cases} \tag{1.15}$$

First assume that all consumers are rational ($\lambda = 0$). Then conditional on producing either good, the firm will price them both at price $p_j = v - v'$. The firm chooses to produce a good if the profits exceed the fixed cost F. That is, it will produce good L if $\sigma(v - v') > F$ and good R if $(1-\sigma)(v - v') > F$.

Now assume that all consumers are categorical ($\lambda = 1$). According to equation 1.15, the maximum price the firm can charge for a good is dependent on whether or not it carries the other good. For example conditional on producing only the single good L (R), the highest price the firm could charge is $p_{L(R)} = v - \frac{v'}{\sigma}$.

If instead the firm produces both goods, then an individual will consider the set of goods $S_1 = \{L, R\}$ if $\sigma[v - p_L] + (1 - \sigma)[v - p_R] \geq v'$. And conditional on considering set S_1, the individual will purchase a good if $MAX\{v - t(1 - \eta_i) - p_L, v - t\eta_i - p_R\} \geq 0$.

This simple example captures the two main features of categorical consideration: coarse thinking and limited consideration. Coarse thinking materializes because consumers do not decide to evaluate goods on a product by product basis, but instead decide whether or not to evaluate the firm's product line as a whole. Limited consideration comes from the fact that after choosing a preferred category, consumers purchase the best good in the bundle conditional on that good providing positive surplus. That is, consumers do not take into account the expected value for other available, but not evaluated goods (i.e. goods outside their consideration set), but act as if the considered goods constituted the full set of available goods.

Monopoly Pricing

To see the impact of categorical consideration on firm pricing behavior, let us first consider the following basic game. In step one, a single firm decides what products (if any) to sell and at what prices conditional on knowing both the distribution of types σ and the share of categorical consumers λ. In step two, individuals see prices and choose which goods to consider.[26] Then in step three, individuals evaluate the considered goods (i.e. learn η_i) and decide whether or not to purchase one of the considered goods.

Proposition 1 *Let M and M' be two markets with a fraction λ and λ' of behavioral consumers where $\lambda \neq \lambda'$. For any set of parameters (v, v', t, σ, F), conditional on entry, the number of product varieties is weakly greater in the market with a larger fraction of categorical considerers.*

Proof: See appendix. ■

The intuition for this result is quite simple: when consumers are categorical considerers, goods have an option value. That is a categorical consumer will purchase a

[26]Fully rational consumers consider all available goods.

good from the firm only if they first decide to seriously consider the firm's products, and by having more varieties the firm increases the expected value of its goods to an individual.

The key implication of this proposition is that conditional on entry, a monopolist's product variety will increase in the share of boundedly rational consumers. In markets (or product spaces) where a larger share of consumers act categorical, we would expect firms to produce a larger number of product varieties than predicted in a fully rational model.

Note, though, that because firms need to produce more varieties for categorical than rational consumers, effective entry costs are higher when consumers are categorical. We will explore the implications of this result in more detail in our analysis of competitive market settings, but the main intuition here is that the presence of categorical consumers biases a market toward multi-product monopoly.

In costly rational search models like that found in Lal & Matutes (1994), products in a store are physically linked together by travel costs. In a similar way, products in a category are mentally linked together by limited consideration. In the same way that in a costly search model firms need to get customers into their store, under categorical consideration firms need to get consumers to mentally consider their goods. Though these two results are mathematically similar, they are quite different in their application. Specifically categorical consideration, unlike rational search models, describes consumer decision making in cases without a clear "cost" linking sets of goods (e.g. travel cost to different retail stores). Instead it applies to any set of goods that consumers partition into mental categories.

1.4.2 Entry Deterrence

One implication of Proposition 1 is that the presence of categorical consumers biases a monopolist toward product proliferation. But as we shall see, the threat of entry creates an additional incentive for a monopolist to produce more varieties as a credible means of entry deterrence.

A long standing argument holds that incumbent firms may be able to deter entry by pre-emptive investment in new goods. For example Schmalensee (1978) argues that incumbent firms use excess product proliferation to deter entry by leaving no niche for potential entrants. The intuition behind spatial preemption can be seen in the following example. Imagine that A and B are the only two possible variants of a good, and that these goods are produced at constant marginal cost after a one time set-up cost. Competition in the market is in prices. The incumbent firm can then preclude entry into the product market by spanning the space (i.e. producing both A and B). Then since post-entry price competition would drive down the price of a newly introduce good to marginal cost, the entrant will make zero profit and will never recover the fixed set-up cost.

More recent work though has brought the theoretical foundations of such spatial preemption into doubt. For example, Judd (1985) shows that as long as incumbents are allowed to exit in response to entry by another firm, spatial preemption is not a credible deterrence to entry. The basic insight of Judd (1985) was to point out that previous models of spatial preemption precluded (limited) exit by the incumbent firm. Absent prohibitively high exit costs, the incumbent has a unique ex-post incentive to stop producing certain product varieties. Specifically, assume that the incumbent produces good A and B while the entrant produces only good A. Then since A and B are substitutes, the intense price competition over good A reduces the price the incumbent is able to charge for good B. The incumbent therefore has an incentive post entry to stop producing good A to weaken competition in the product space in general; an incentive the entrant importantly does not share. Therefore as long as the incumbent does not face prohibitively high exit costs, spatial preemption is not a credible entry deterrence strategy.

The presence of categorical considerers restores credibility to spatial preemption as a strategy for entry deterrence. To see this in more detail, I examine a variant of the entry game in Judd (1985). Specifically I combine the model presented in the previous section with the four stage entry game described in Figure 1. Though for reasons of rhetorical simplicity I continue to use a model with only two possible goods, it will hopefully be clear that the basic argument holds in general.

t=1	t=2	t=3	t=4
Firm 1 chooses to produce L, R, both or neither and pays necessary entry costs.	Firm 2 chooses to produce L, R, both or neither and pays necessary entry costs.	Both firms make exit choices and pays necessary exit costs.	Firms play the duopoly pricing game.

Figure 1-1: Sequential Entry Model

In the first stage, firm 1 decides what products (if any) to sell. In the second stage firm 2 (the potential entrant) sees what products the incumbent has chosen to produce and decides which products to produce. In the third stage both firms simultaneous make exit decisions (i.e. decide which products, if any, to stop producing). In the fourth and final stage, the market structure is set and the firm(s) set price(s) for a market consisting of a measure one of consumers.

Notationally, the two firms are be indexed by $k \in \{1,2\}$, where 1 and 2 denote the incumbent firm and potential entrant, respectively. Price for good j produced by firm k is then written as $p_{j,k}$. Each firm can produce goods L and R at constant marginal costs c_j and must pay a an irretrievable one-time entry cost F_e to produce good j and a non-negative exit cost F_x to exit the market for each good j.

As in the previous section, there are a measure one of homogeneous consumers with unit demand for at most one good. Utility from product $j \in \{L, R, j_0\}$ is

$$u_i(j, p_j; \xi_i) = \begin{cases} v + t(1-\xi_i) - p_L & \text{if } j = L \\ v + t\xi_i - p_R & \text{if } j = R \\ v' & \text{if } j = j_0 \end{cases} \tag{1.16}$$

where $\xi_i \in \{0,1\}$, $Pr(\xi_i = 1) = \sigma$, and j_0 is the outside option (e.g. non-purchase). WLOG I set $v' = 0$ $c_j = 0\ \forall j$. I further assume $t < V$ so that the goods L and R are similar enough to be viable substitutes.

Proposition 2 *Let all consumers be fully rational. If there exists a pure strategy equilibrium that supports a differentiated duopoly that is profitable net of fixed cost,* *then for low enough exit costs ($F_x < \underline{F}_x$) the incumbent firm cannot credibly prevent entry by crowding the product space.*

Proof: See appendix. ■

The intuition behind the proof of the proposition is the same as in the more general case presented in Judd (1985). Specifically, if firm 2 enters the market for just one of the two goods, for low enough exit costs, the profit maximizing strategy for the incumbent post-entry is to accommodate entry, and exit the contested market. Because the competition in the overlapping good adversely affects the profit the firm earns on the other good, multi-product incumbents have an ex-post incentive to accommodate entry and thereby weaken competition in the market as a whole. Importantly firm 2 faces no ex-post incentive to exit so will never exit a market for any non-negative exit cost.

Proposition 3 *Let all consumers be categorical considerers. The incumbent firm can successfully (credibly) preclude entry by crowding the the product space.*

Proof: See appendix. ■

This result is due to the fact that in a market of categorical considerers, the incumbent firm does not face an ex-post incentive to (partially) exit the market. For concreteness, consider the possible competitive stage 4 outcomes where $\sigma = \frac{1}{2}$ (Figure 1).

From Table 1-I it is clear that regardless of firm 2's strategy in stage 3, firm 1 is always weakly better off producing whichever goods it has the capacity to produce. Consider the case where both firm 1 and 2 enter stage 3 with the capacity to produce both good L and R. Firm 2's has four possible strategies: stay in both markets, stay in the market for L, stay in the market for R, completely exit the market. Then for all four possible strategies, staying in both markets is at least as good for firm 1 as any other possible strategy. For example if firm 2's strategy is to stay in both markets, firm 1 will earn zero profit from sales regardless of what firm 1 does. Then for any non-negative exit cost F_e, firm 1's best response is to not exit either market. A similar argument holds for any other possible strategy by firm 2; and since the incumbent

Products		*Sales*	
Firm 1	*Firm 2*	*Firm 1*	*Firm 2*
L,R	L,R	0	0
L,R	L	$\frac{t}{2}$	0
L,R	R	$\frac{t}{2}$	0
L,R	$\oslash$	v	0
L	L,R	0	$\frac{t}{2}$
L	L	0	0
L	R	0	0
L	$\oslash$	$\max\{\frac{v}{2},v-t\}$	0
R	L,R	0	$\frac{t}{2}$
R	L	0	0
R	R	0	0
R	$\oslash$	$\max\{\frac{v}{2},v-t\}$	0
$\oslash$	L,R	0	0
$\oslash$	L	0	$\max\{\frac{v}{2},v-t\}$
$\oslash$	R	0	$\max\{\frac{v}{2},v-t\}$
$\oslash$	$\oslash$	0	0

Table 1-IV: Possible Stage 4 Competitive Outcomes

firm does not have an ex-post incentive to exit the market, any non-negative exit cost is sufficient to ensure that for an incumbent, exiting a market will never be a best response to entry by another firm.

The reason this result differs from that in the fully rational case lies in the nature of the competition between firms in these two cases. When consumers are fully rational, firms directly compete in price for consumers only for goods they both produce and any impact on other goods are due to spillover effects. If instead consumers are categorical considerers, firms compete not product by product, but rather product-line by product-line. As such exiting from a highly contested market does not decrease the competition between the firms in other markets. But since having more products increases the attractiveness of a product line, it does have the effect of weakening the exiting firm's overall ability to compete with another firm.

1.4.3 Brand Name Premium

A consistently observed but somewhat striking empirical fact is the significant price premium branded products have over physically identical generic goods. Although the standard argument that branded goods are of higher quality than generics is surely correct in many instances, in many others it seems quite implausible. For example even though Chlorox bleach is chemically and Reynolds Aluminum Foil is physically identical to their generic equivalents, the branded goods still sell at significant price premiums.[27]

Another particularly striking example is the existence of "branded generics." Though studied most often in the context of entry deterrence, one somewhat surprising fact is that pharmaceutical firms occasionally sell generic versions of their good.[28] These so called "branded generics" are *physically identical* to the branded good, manufactured often in the same plant in the same production lines, but sold under a different trade name.[29] Even in the presence of branded generics, the branded drug not only sells at a significant premium compared to the branded generic, but also maintains a significant market share.

Consider the model of horizontal consumer taste differentiation from the previous section where thee market contains a heterogeneous mix of consumer types. As before there are two feasible horizontally differentiated varieties of a good denoted by $\{L, R\}$, and consumer utility from purchasing a good is given by

$$u_i(j, p_j; \xi_i) = \begin{cases} v + t(1-\xi_i) - p_L & \text{if } j = L \\ v + t\xi_i - p_R & \text{if } j = R \\ v' & \text{if } j = j_0 \end{cases} \tag{1.17}$$

where j_0 is the outside option. As before $\xi_i \in \{0,1\}$, but now $Pr(\xi_i = 1) = \theta_i$ and distribution of θ_i is characterized by a CDF $F(\theta)$.

[27]On 9/11/2008 the online grocery store Peapod sold Chlorox bleach and Reynolds Aluminum Foil at a 30.0% and 43.0% higher than the available generic equilvalents.

[28]See for example Liang (1996), Ferrandiz (1999) and Kamien & Zang (1999).

[29]Hollis (2003).

A fraction λ of all consumers are categorical considerers who use product brand (i.e. the manufacturing firm) to partition products. The remaining $1 - \lambda$ consumers are fully rational (i.e. their consideration sets are the full set of available goods).

I model competition between a small regional brand and a large national brand as follows. Notationally I refer to the national brand as firm A and the regional brand as firm B: $k \in \{A, B\}$. The national brand can produce either varieties of the good $S_A = \{L, R\}$ while the regional brand can only produce one variety $S_B = \{L\}$. All goods are produced at a constant marginal cost c which WLOG I set to zero.

Analogous to the small open economy assumption in Macroeconomics, I assume that the national brand does not adjust its strategy in response to the regional brand. Though the argument presented here holds as long as the national brand has monopoly power over some fraction of the population, a detailed general analysis would be tedious and detract from the basic point.

Assume then that the national brand sets prices $p_A \equiv p_{A,L} = p_{A,R} < v$. Since firm B produces only one good, for notational simplicity I will drop the j subscript and refer to $p_{B,L}$ simply as p_B.

Proposition 4 *Let all consumers be fully rational ($\lambda = 0$). The regional brand's profit maximizing strategy is to price ϵ below the national brand's price for the identical good L_A.*

Proof: Since L_A and L_B are undifferentiated (i.e. identical) goods, consumers will buy from the firm that charges the lowest price. And since demand for L_B is constant for any price $p_B < p_A$, the regional brands best response is to just undercut firm A's price on good L. ■

Proposition 5 *The regional brand's profit maximizing price $p^*_{B,L}$ is decreasing in the share of categorical considerers: $p^*_{B,L}(\lambda') \leq p^*_{B,L}(\lambda)\ \forall\ \lambda' > \lambda$.*

Proof: A consumer of type θ will consider the regional brand if $U(S_B, p_B) \geq U(S_A, p_A)$. Therefore the marginal customer type that considers the regional brand is given by

$$
\begin{aligned}
& v - p_A = (1-\theta)[v + t - p_B] + \theta[v - p_B] \\
& v - p_A + t = v - p_B - (1-\theta)t \\
& \implies \theta^* = \tfrac{p_A - p_B}{t}
\end{aligned} \tag{1.18}
$$

For $p_B < p_A$, the demand faced, and profit earned, by the regional brand product is then

$$D_B(p_B|p_A, \lambda) = (1-\lambda) + \lambda F(\theta^*) \tag{1.19}$$

$$\pi_B(p_B|p_A, \lambda) = [(1-\lambda) + \lambda F(\theta^*)]p_B \tag{1.20}$$

respectively. Taking the first order condition I find

$$\frac{\partial \pi}{\partial p_B} = (1-\lambda) + \lambda\left[F(\theta^*) - \frac{p_B}{t} f(\theta^*)\right] = 0, \tag{1.21}$$

where $f(\cdot)$ is the pdf of the distribution of consumer types. Some simple algebraic manipulation of the FOC leads to the condition

$$\left(1 - \frac{1}{\lambda}\right) = F(\theta^*) - \frac{p_B}{t} f(\theta^*). \tag{1.22}$$

Note that the left hand side of equation 1.22 is increasing in λ: $\frac{\partial}{\partial \lambda}\left(1 - \frac{1}{\lambda}\right) > 0$. As such, to prove that p_A is decreasing in λ it is sufficient to show that the right hand side of equation 1.22 is decreasing in p_A.

For a small change in p_A the change in the right hand side of equation 1.22 is given by

$$
\begin{aligned}
\frac{\Delta}{\Delta p_A}\left(F(\theta^*) - \frac{p_B}{t}f(\theta^*)\right) &= f(\theta^*)\Delta p_A - \frac{1}{t}\left(f(\theta^*)\Delta p_A + \mathcal{O}(p_A^2)\right) \\
&= -(1+\frac{1}{t})f(\theta^*)\Delta p_A - \frac{1}{t}\mathcal{O}(p_A^2) \qquad (1.23) \\
&\approx -(1+\frac{1}{t})f(\theta^*)\Delta p_A.
\end{aligned}
$$

As $\Delta p_A \to 0$, we can ignore the higher order terms, and since the pdf $f(\cdot)$ is non-negative, the expression is decreases in p_A. ■

This predicted pattern of behavior (i.e. brands with more extensive produce lines charge higher prices) is one largely consistent with the observation that branded goods have both more variety and higher prices than their generic equivalents. Returning to the previously discussed cases of bleach and aluminum foil, we see that the national brands tend to not only be priced higher, but have more varieties than their generic equivalents.[30]

1.4.4 Differentiation Through Brands

So far all our examples have focused on optimum firm behavior when product categories were fixed (i.e. consumers partition goods by brand). The main result of the previous examples have involved how firms can use genuine product differentiation to their advantage when consumers are categorical. In this example, I show how a firm can use branding to artificially create product differentiation.

Though a full discussion of this topic is beyond the scope of this paper, I briefly discuss categorical consideration as a micro-foundation for product placement and non-informational advertising.

It is now standard practice for manufacturers to pay retailers to determining where their products are displayed in store. Though some product placement is a means of lowering product search costs (e.g. end of aisle displays or multiple facings), other

[30]On 9/11/2008 the online grocery store Peapod sold 7 variants of Chlorox bleach compared to 2 variants of the generic bleach and 4 versions Reynolds Aluminum Foil compared to 2 variants of generic foil.

times it is done for the purpose of keeping a brand physically separate from competing goods, especially generic equivalents.

Under categorical consideration, leading brands may have an incentive to keep their products physically separated from competing goods if such physical placement induces consumers to treat their brand as a separate category. As a specific example, consider the previously discussed experiment involving bottled water. Given the large drop in Aquafina sales when a less expensive, competing brand was mixed across coolers as opposed to being located in separate but adjacent coolers, Poland Springs clearly has an incentive to pay retailers to keep their products physically separate from bottles of Aquafina.

Categorical consideration also offers a potential rational for certain types of non-informational advertising. In economics advertising is generally modeled as either a means of providing information about a good, or more controversially as a means of directly affecting the utility of the advertised good. Though few would argue that all advertising is informational,[31], recent work has shown informationless advertising having an impact far to large to be reasonably explained by the idea of non-informative advertising as a good.[32]

Unlike strictly rational models of advertising as a good, under categorical consideration non-informational advertising does not directly impact consumer utility for the advertised good, but instead affects demand indirectly by changing the way consumers partition goods. And as we have seen in the bottled water experiment, changes in the physical partitioning of goods can lead to large changes in demand. In so far as informationless advertising can increase the salience of brands and change the way consumers mentally categorize goods, firms may have an incentive to use such branding in an attempt to differentiate their products.

For example in 2006 First Marblehead, one of the dominant providers of private education lending in the US, marketed their student loan products through several

[31]For example even though Coca-Cola has been the U.S.'s leading soft drink maker for almost a century, it spends over $200 million a year in advertising.

[32]In an experiment run in Bertrand et al. (2008), the authors found that by simply including the photo of an attractive female in direct mail loan offers, they could increase take up equivalent to a 5 percentage point drop in the interest rate.

different brands. Although each brand had its own unique identity, advertising campaign, etc. they each offered the exact same loans. The idea behind this marketing strategy was to create the illusion of product differentiation for a homogeneous financial instrument - that is, to use product branding to differentiate money.

To fix the idea, consider the case of the auto manufacturer Toyota. Toyota is a brand best known as a high quality manufacturer of mid-range cars, but in the 1980s it wanted to start competing in the high end market against brands like BMW and Mercedes Benz. In the absence of categorical consideration, Toyota's reputation for quality and reliability in the mid-range cars would be an asset in competing in the high end market, as would the ability to leverage the extensive network of Toyota dealerships and brand recognition. Instead Toyota chose to create a new brand Lexus under which to market and sell their new high end automobiles.

Consider a consumer deciding which brands to considers under two alternate scenarios. In the first Toyota sells both mid-range and luxury models under one brand. In the second, Toyota sells their mid-range and luxury cars as different brands. Assume that selection of luxury Toyota models is identical in both scenarios and that an identical car purchased in either scenario provides the same level of utility to the buyer (i.e. the different dealerships do not provide significantly different levels of amenities, nor is there any intrinsic benefit to the consumer from the brand itself).

For simplicity assume Toyota sells only only two vertically differentiated cars M and H at prices p_M and p_H. In addition to Toyota let there be two other firms $k = m, h$ where firms 1 and 2 manufactures a mid-range and high-end cars respectively. These products are denoted by M' and H' and sold at prices p'_M and p'_H. All firms can produce all goods at constant marginal cost c.

Consumers differ along two dimensions: whether or not they value "luxury" α and a horizontal taste parameter θ. Let there be a unit mass of consumers who do not value luxury ($\alpha = 0$) and a unit mass of consumers with do ($\alpha = 1$). Consumer i who value luxury derive utility $U_i^v = v$ from luxury cars, and zero utility from mid-range cars while the opposite is true for consumers who do not value luxury. In addition the stochastic term $\eta i \in \{0, t\}$ determines which firms car matches their personal tastes.

Consumers buy at most one car and receive zero utility from not making a purchase. A fraction λ of all consumers are categorical and $Pr(\eta = t) = \frac{1}{2}$. The utility a consumer of type (α, θ) will obtain from purchasing a good is then given by

$$u(j, p_j; \alpha, \eta) = \begin{cases} (1-\alpha)v_M - p_M - t\eta & \text{if } j = M \\ (1-\alpha)v_M - p'_M - t(1-\eta) & \text{if } j = M' \\ \alpha v_H - p_H - t\eta & \text{if } j = H \\ \alpha v_H - p'_H - t(1-\eta) & \text{if } j = H' \\ 0 & \text{if } j = \emptyset \end{cases} \tag{1.24}$$

where $v_H > v_H$.

For categorical considerers cars are in one of two categories: manufacturers of midrange cars (S_m) and manufacturers of high-end automobiles (S_h). Assume that if Toyota sells luxury cars under a single Toyota brand, it will be classified as a mid-range manufacturer.

Consider then the following three period game. In the first period Toyota decides whether or not to pay a cost $F > 0$ to create a second brand Lexus for their luxury cars. In the second period, each firm simultaneously chooses prices. In the third period consumers observe prices and decide which car, if any, to purchase. As before, I restrict my analysis to pure strategy equilibria.

Proposition 6 *Suppose consumers are rational ($\lambda = 0$). Then, in equilibrium, Toyota will never create a second brand.*

Proof: The proof follows immediately from the fact that when consumers are rational, utility (and demand) is unaffected by uninformative branding, so Toyota will never pay any positive cost to create a new brand. ■

Proposition 7 *Suppose a fraction λ of consumers are categorical considerers. If there exists a pure strategy equilibrium that supports a differentiated oligopoly, then there exists an $\bar{F} > 0$ such that for $F < \bar{F}$ Toyota will differentiate its products through the creation of an uninformative second brand.*

Proof: See appendix. ■

The main implication of Proposition 8 is that informationless branding can emerge as a market equilibrium. In this equilibrium, a firm that manufactures goods that span mental categories have an incentive to create additional brands. These additional brands are not an objectively believable source of information, but allow a firm to differentiate its products in the minds of categorical considerers. Put another way, when consumers use product brand as a means to reduce a set of alternatives to a more manageable consideration set, dividing a product line into multiple brands allows a firm to more effectively target specific consumers.

This result is in direct opposition to the standard model in which a larger product-line must be (weakly) more attractive to consumers - i.e. more is better. For example if there were a fixed cost to visiting a dealership, conditional on prices, a dealership has a built in advantage over another dealership whose product line is a strict subset of its own. But when consumers are categorical, they do not compare goods item by item, but instead brand by brand. This idea that firms compete with each other not in terms of equivalent products, but instead in terms of brands or entire product lines, is consistent with discussions the marketing literature.[33]

1.5 Conclusion

This paper presents a simple model of boundedly rational decision making that explains both a diverse set of non-rational consumer behavior, but also seemingly anomalous marketing strategies by firms. Specifically when product categories are fixed I find that when consumers are categorical, markets tend toward multi-product monopoly in comparison to the rational baseline. In addition the option value of goods when consumers are boundedly rational leads to market equilibriums in which a firms with larger product lines can charge higher prices for physically identical goods. If instead firms can manipulate consumer categories, I show how firms can differentiate their products through brand creation.

[33] See for example Katz (1984) or Brander and Eaton (1984).

In the model presented here individuals have well defined preferences, but exhibit two biases compared to fully rational consumers. First because of limited consideration, individuals choose the utility maximizing good from a limited subset of alternatives. Second since individual preference are applied coarsely to categories, the probability that an alternative is considered is affected by other "irrelevant" products. The model includes the standard rational model as a special case.

Perhaps the most common critique of behavioral models is that because they can accommodate most any choice behavior, they are not actually informative. One advantage of categorical consideration, relative to most behavioral models, is that it provides a restrictive framework for decision making that still manages to explain a range of interesting behavioral anomalies. Because decision making is based on a single well behaved preference relation, many of the insights, intuitions, and empirical methods based on the standard model either apply directly to, or have simple analogues in, categorical consideration. Conditional on categories, the fact that consumers have a single well behaved set of preference means that those preferences are identifiable from choice data. Then insofar as a consumer's choice of categories is amenable to economic intuition (or experimental validation), welfare analysis and counterfactual testing is possible using commonly available datasets.

1.A Appendix: Proofs

1.A.1 Proof of Proposition 1

Let M and M' be two markets with a fraction λ and λ' of behavioral consumers where $\lambda \neq \lambda'$. For any set of parameters (v, v', t, σ, F), conditional on entry, the number of product varieties is weakly greater in the market with a larger fraction of categorical considerers.

Proof: First consider firm profit when a monopolist enters both markets. All consumers are willing to purchase a good if the price for their preferred good is less than or equal to $v - v'$: $p_L = p_R = v - v'$. Categorical consumers though will consider the firms good if and only if

$$\sigma[v - p_L] + (1 - \sigma)[v - p_R] \geq v';$$

a condition that is met when $p_L = p_R = v - v'$. Since the profit maximizing price is identical for both rational and categorical consumers, profit is invariant to the share of categorical consumers λ: $\pi = v - v'$ and $\frac{\partial \pi}{\partial \lambda} = 0$.

Now consider firm profit when a monopolist enters the market for just good L. A fraction σ of the consumers will purchase good L if $p_L \leq v - v$ while a fraction $(1 - \sigma)$. Categorical consumers though will consider the good if and only if

$$\sigma[v - p_L] \geq v'.$$

The maximum price the monopolist can charge a categorical consumer is then $p_L^c = v - \frac{1}{\sigma}v'$. Since $p_L^c < v - v'$, the firms profit maximizing strategy will be to either set price at $p_L^r = v - v'$ and sell to only the rational consumers, or set price a lower price $p_L^c = v - \frac{1}{\sigma}v'$ and sell to both rational and categorical consumers. In the former case firm profits decrease monotonically to zero as the share of rational consumers approaches zero, while in the latter case profit is invariant to consumer type.

An identical argument produces the same result for the case when the monopolist enters the market for just good R.

Since a monopolist's profit from producing both goods is independent of λ and its profit from producing a single good is weakly decreasing in λ, if $\pi_L(|\lambda = 0) > \pi_{both} > 0$ there exists a $\bar{\lambda} \in (0, 1)$ such that a monopolist's profit maximizing strategy will be to produce a single good if $\lambda < \bar{\lambda}$ and produce both goods if $\lambda \geq \bar{\lambda}$. ■

1.A.2 Proof of Proposition 2

Let all consumers be fully rational. If there exists a pure strategy equilibrium that supports a differentiated duopoly that is profitable net of fixed cost, then for low enough exit costs ($F_x < \underline{F}_x$) the incumbent firm cannot credibly prevent entry by crowding the product space.

Proof: Consider the possible equilibrium outcomes for the stage-four game condition (see Table 1-V). If a firm is alone in the market, the firm extract all surplus from the consumer. If both firms are in a single and identical market, the price competition drives the price of the good to marginal cost.

If the two firms each produce one of the two goods, then the pure strategy equilibrium for a differentiated duopoly exists if and only if $\sigma v \geq v - t$ and $(1 - \sigma)v \geq v - t$. If these two conditions are met then the equilibrium prices are $p_{k,L} = p_{-k,R} = v$. Firm k then earns $\pi_L = (1 - \sigma)v$ and firm $-k$ earns $p_R = \sigma v$.

Finally if one firm products both goods and the other just one, then price of the common good is driven to marginal cost and the price of unique good is t (otherwise consumers would choose the common good).

Assume the incumbent enters both markets in stage-one. Then in stage-two the firm 2 can choose to enter market L, market R, both markets, or none. There are then four stage-three subgames in which firms simultaneously decide which markets, if any, to exit. The payoffs for the stage-three subgames are presented in Table 1-VI.

Consider the subgame where firm 2 enters market L (Case 1). If $\sigma t > \sigma v - F_x$, the unique pure strategy equilibrium is (*No Exit, No Exit*). If instead $\sigma t < \sigma v - F_x$, the unique pure strategy equilibrium is (*Exit L, No Exit*). So there exists a $\underline{F}_x > 0$

Table 1-V: Stage-Four Game Equilibrium Outcomes ($\lambda = 0$)

	Firm 1			
Firm 2	*Both*	*L*	*R*	$\oslash$
Both	0, 0	$(1-\sigma)t$, 0	σt, 0	v, 0
L	0, $(1-\sigma)t$	0, 0	σv, $(1-\sigma)v$	0, $(1-\sigma)v$
R	0, σt	$(1-\sigma)v$, σv	0, 0	0, σv
$\oslash$	0, v	0, $(1-\sigma)v$	0, σv	0, 0

such that the incumbent will accommodate entry in the stage-three subgame if $F_x < \underline{F}_x = \frac{v-t}{\sigma}$.

The subgame where the firm 2 enters market R (Case 2) is clearly analogous, and leads to the condition that the incumbent will accommodate entry if $F_x < \underline{F}_x = \frac{v-t}{1-\sigma}$.

The most complicated subgame is where firm 2 enters both markets (Case 3). Though there can be multiple equilibria, for the purposes of the proof simply note that the best equilibrium outcome for a firm is for one of them to produce only L and the other only R. This provides an upper bound for each firms payoff in the double entry subgame. The key result here is that given the fact that this upper bound is strictly less than when firm 2 enters a single market, the potential entrant will never find it advantageous to enter both markets.

In comparison Case 4, where the firm 2 does not enter either market, is trivial - the entrant earns zero and the incumbent always chooses the no-exit strategy.

Since by assumption the market can support, net entry costs, a differentiated duopoly, firm 2 will always enter in stage-two when exit costs are low enough. The incumbent firm will therefore cannot prevent entry by producing both goods. ■

1.A.3 Proof of Proposition 3

Let all consumers be categorical considerers. The incumbent firm can successfully (credibly) preclude entry by crowding the the product space.

Proof:

Table 1-VI: Stage-Three Sub-Games ($\lambda = 0$)

Case 1: Entrant Enters Market L

Firm 2 \ Firm 1	Stay in Both	Exit R	Exit L	Exit Both
Stay in L	$0,\ \sigma t$	$0,\ -F_x$	$(1-\sigma)v,\ \sigma v - F_x$	$(1-\sigma)v,\ -2F_x$
Exit L	$-F_x,\ v$	$-F_x,\ (1-\sigma)v - F_x$	$-F_x,\ \sigma v - F_x$	$-F_x,\ -2F_x$

Case 2: Entrant Enters Market R

Firm 2 \ Firm 1	Stay in Both	Exit R	Exit L	Exit Both
Stay in R	$0,\ (1-\sigma)t$	$\sigma v,\ (1-\sigma)v - F_x$	$0,\ -F_x$	$\sigma v,\ -2F_x$
Exit R	$-F_x,\ v$	$-F_x,\ (1-\sigma)v - F_x$	$-F_x,\ \sigma v - F_x$	$-F_x, -2F_x$

Case 3: Entrant Enters Both Markets

Firm 2 \ Firm 1	Stay in Both	Exit R	Exit L	Exit Both
Stay in Both	$0,\ 0$	$(1-\sigma)t,\ -F_x$	$\sigma t,\ -F_x$	$v,\ -2F_x$
Exit R	$-F_x,\ (1-\sigma)t$	$-F_x,\ -F_x$	$\sigma v - F_x,\ (1-\sigma)v - F_x$	$-2F_x,\ (1-\sigma)v - F_x$
Exit L	$-F_x,\ \sigma t$	$(1-\sigma)v - F_x,\ \sigma v - F_x$	$-F_x,\ -F_x$	$-2F_x,\ \sigma v - F_x$
Exit Both	$-2F_x,\ v$	$-2F_x,\ (1-\sigma)v - F_x$	$-2F_x,\ \sigma v - F_x$	$-2F_x,\ -2F_x$

Case 4: Entrant Does Not Enter

Firm 2 \ Firm 1	Stay in Both	Exit R	Exit L	Exit Both
N/A	$0,\ v$	$0,\ (1-\sigma)v - F_x$	$0,\ \sigma v - F_x$	$0, -2F_x$

Table 1-VII: Stage-Four Game Equilibrium Outcomes ($\lambda = 1$)

		Firm 1		
Firm 2	*Both*	*L*	*R*	$\oslash$
Both	0, 0	t, 0	t, 0	v, 0
L	0, t	0, 0	0, $(2\sigma-1)t$	$max\{(1-\sigma)v+t, v\}$, 0
R	0, t	$(2\sigma-1)t$, 0	0, 0	$max\{\sigma v+t, v\}, 0$
$\oslash$	0, v	0, $max\{(1-\sigma)v+t, v\}$	0, $max\{\sigma v+t, v\}$	0, 0

WLOG assume $\sigma \geq \frac{1}{2}$ and consider the possible equilibrium outcomes for the potential stage-four sub-games (See Table 1-VII). If both firms are in identical markets (i.e. (*Both, Both*), (*L,L*), (*R,R*)), price is driven down to marginal cost ($c = 0$) and neither firm earns a profit. Similarly if both firms are in neither market (i.e. ($\oslash$, $\oslash$)), neither firm earns a profit.

If there is only a single firm in a single market L, the firm will either price at v and sell to all consumers or to price at $v + \frac{t}{1-\sigma}$ and sell to a fraction $1-\sigma$ of all consumers. Similarly if a lone firm is only in market R, the firm can price at v and sell to all consumers or to price at $v + \frac{t}{\sigma}$ and sell to a fraction σ of all consumers.

Consider the differentiated duopoly case where the two firms each produce one of the two goods. For $v > t$, the only pure strategy equilibrium has prices $p^*_{k,L} = 0$ and $p^*_{k',R} = (2\sigma - 1)t$ and all consumers consider and purchase good R.

To check that this is indeed an equilibrium note that at these prices consumers are just prefers brands k' to brand k (see Equation 7). Then firm k cannot decrease $p^*_{k,L}$ without pricing below marginal cost, and increasing $p^*_{k,L}$ does not increase demand from zero. For firm k', decreasing price simply decrease marginal revenue without affecting demand, while increasing price drives demand (and profit) to zero.

Finally consider the case where firm k produces both goods and firm k' produces a single good which WLOG I will assume is good R. The pure strategy equilibrium for this case are $p^*_{k',R} = 0$ and any $(p^*_{k,L}, p^*_{k,R})$ that satisfies the following conditions:

C1: $(1-\sigma)p^*_{k,L} + \sigma p^*_{k,R} = t$.

C2: $min\{p^*_{k,j}\} \geq 0$ for $j \in \{L, R\}$

$C1$ guarantees that all consumers will consider firm k while $C2$ maximizes the profit from consumers once they consider the multi-product firms goods.

From Equation 7, we see that the proposed equilibrium sets prices such that consumers are just indifferent between considering the brands. Then firm k' cannot decrease $p^*_{k,L}$ without pricing below marginal cost, and increasing $p^*_{k,L}$ does not increase demand from zero. If $(1-\sigma)p^*_{k,L} + \sigma p^*_{k,R} > t$, then no-one considers firm k's goods. If $(1-\sigma)p^*_{k,L} + \sigma p^*_{k,R} < t$, the firm would be able to increase prices without affecting demand. Condition $C2$ ensures that all consumers who consider the multi-product brand purchase one of the two items. Note that, conditional on the constraints, revenue is simply t and invariant to the specific $(p^*_{k,L}, p^*_{k,R})$.

Assume the incumbent enters both markets in stage-one. Then in stage-two the firm 2 can choose to enter market L, market R, both markets, or none. There are then four stage-three subgames in which firms simultaneously decide which markets, if any, to exit. Combining the stage-four game payoffs with exit costs, we can calculate the payoffs from the various stage-three subgames. These results are presented in Table 1-VIII.

Then for any positive exit cost $F_x > 0$, for each of the four subgames the strategy (*No Exit, No Exit*) is the unique Nash Equilibrium. That is, a firm's best response to any strategy by the other firm is to not exit any market.

In equilibrium, firm 2 does not earn positive revenue in any of the stage-three subgames, so for any positive entry cost $F_e > 0$, firm 2 will not enter in stage-two. Then by entering both markets in stage-one, the incumbent deters entry by firm 2. ■

1.A.4 Proof of Proposition 7

Suppose a fraction λ of consumers are categorical considerers. If there exists a pure strategy equilibrium that supports a differentiated oligopoly, then there exists an $\bar{F} > 0$ such that for $F < \bar{F}$ Toyota will differentiate its products through the creation of an uninformative second brand.

Table 1-VIII: Stage-Three Sub-Games ($\lambda = 1$)

Case 1: Entrant Enters Market L

	Firm 1			
Firm 2	*Stay in Both*	*Exit R*	*Exit L*	*Exit Both*
Stay in L	$0,\ t$	$0,\ -F_x$	$0,\ (2\sigma-1)t - F_x$	$max\{(1-\sigma)v + t, v\},\ -2F_x$
Exit L	$-F_x,\ v$	$-F_x,\ max\{(1-\sigma)v + t, v\} - F_x$	$-F_x,\ max\{\sigma v + t, v\}$	$-F_x,\ -2F_x$

Case 2: Entrant Enters Market R

	Firm 1			
Firm 2	*Stay in Both*	*Exit R*	*Exit L*	*Exit Both*
Stay in R	$0,\ t$	$(2\sigma-1)t,\ -F_x$	$0,\ -F_x$	$max\{\sigma v + t, v\},\ -2F_x$
Exit R	$-F_x,\ v$	$-F_x,\ max\{(1-\sigma)v + t, v\} - F_x$	$-F_x,\ max\{\sigma v + t, v\}$	$-F_x,\ -2F_x$

Case 3: Entrant Enters Both Markets

	Firm 1			
Firm 2	*Stay in Both*	*Exit R*	*Exit L*	*Exit Both*
Stay in Both	$0,\ 0$	$t,\ -F_x$	$t,\ -F_x$	$v,\ -2F_x$
Exit R	$-F_x,\ t$	$-F_x,\ -F_x$	$-F_x,\ (2\sigma-1)t - F_x$	$max\{(1-\sigma)v + t, v\} - F_x,\ -2F_x$
Exit L	$-F_x,\ t$	$(2\sigma-1)t - F_x,\ -F_x$	$-F_x,\ -F_x$	$max\{\sigma v + t, v\} - F_x,\ -2F_x$
Exit Both	$-2F_x,\ v$	$-2F_x,\ max\{(1-\sigma)v + t, v\} - F_x$	$-2F_x,\ max\{\sigma v + t, v\}$	$-2F_x,\ -2F_x$

Case 4: Entrant Does Not Enter

	Firm 1			
Firm 2	*Stay in Both*	*Exit R*	*Exit L*	*Exit Both*
N/A	$0,\ v$	$0,\ max\{(1-\sigma)v + t, v\} - F_x$	$0,\ max\{\sigma v + t, v\}$	$0, -2F_x$

Proof: If all consumers were rational, the set of prices $(p_M, p'_M, p_H, p'_H) = (v_M, v_M, v_H, v_H))$ where each brand sells to the consumers that prefer their brand is a pure strategy equilibrium. Toyota's revenues are then

$$\pi^r(\lambda = 0) = \frac{v_M + v_H}{2} - c.$$

To check that this is a pure strategy equilibrium, first note that in each market the a firm cannot increase price (otherwise demand goes to zero). If the a firm decrease it's price by t, it can exactly double demand. So if $\frac{1}{2}(v_M - c) \geq v_M - c - t$ and $\frac{1}{2}(v_H - c) \geq v_H - c - t$, the proposed strategy is an equilibrium.

Consider next the case where one of these two conditions is not met. Then if one firm sets price $p_{j,k} > c + t$, the other firm (k') in the market has an incentive to undercut the price by t and capture all the consumers so both firms will want to price t above marginal cost. But there cannot be a symmetric equilibrium since for any price $p_{j,k}$, the firm (k') can increase price to $p_{j,k} + t$ without affecting demand.

Categorical consumers will consider only one category of goods. If Toyota sells its cars under one brand, then categorical consumers partition cars into mid-range brands $S_M = \{M, M', H\}$ and luxury brands $S_H = \{H'\}$. Since all the mid-range cars are in set S_M as long as $min\{p_M, p'_M\} \leq v$ all consumers of type $\alpha = 0$ will consider set S_M.

For a consumer of type $\alpha = 1$, the expected value of considering set S_M and S_M are

$$U(S_M) = v - \frac{t}{2} - p_H, \text{ and}$$
$$U(S_H) = v - \frac{t}{2} - p'_H,$$

respectively. So if all consumers were categorical, the competitive equilibrium is $p_M = p'_M = v$, $p_H = p'_H = c$. Toyota's profit is then

$$\pi(\lambda = 1) = v_M - c.$$

For the more general case of $\lambda \in (0, 1)$, it is only important to note that there are no pure strategy equilibria, and that for any mixed strategy $\pi(\lambda) < \frac{v_M + v_H}{2} - c$ for all $\lambda \in (0, 1]$. That is under no mixed strategy can the firms extract the full surplus from consumers.

If Toyota sells its cars under a new brand, then categorical consumers partition into mid-range brands $S_M = \{M, M'\}$ and luxury brands $S_H = \{H, H'\}$. Then consumers of type $\alpha = 0$ will consider set S_M if $min\{p_M, p'_M\} \leq v$, and similarly consumers of type $\alpha = 1$ will consider set S_H if $min\{p_H, p'_H\} \leq v$. Since the rational equilibrium prices satisfy these conditions, if Toyota create a new brand, it will earn profits of

$$\hat{\pi}(\lambda = 1) = \tfrac{v_M + v_H}{2} - c - F$$

where F is a one time fixed cost for creating a new brand, regardless of the share of categorical consumers (λ). That is if Toyota create a new brand it will earn $\hat{\pi}(\lambda) = \frac{v_M + v_H}{2} - c - F$ for all $\lambda \in [0, 1]$.

If all consumers were categorical ($\lambda = 1$), Toyota would pay F to create a new brand if F satisfies:

$$\hat{\pi}(\lambda = 1) \geq \pi(\lambda = 1) \;\Rightarrow\; F \leq v_H - c.$$

More generally, if $F < \frac{v_M + v_H}{2} - c - \pi(\lambda)$ Toyota will choose to create a new brand. And since $\pi(\lambda) < \frac{v_M + v_H}{2} - c$ for $\lambda > 0$, there exits a $\bar{F} > 0$ such that for $F < \bar{F}$, Toyota has incentive to pay to create a new brand. ■

Chapter 2

What is the Mission of a Not-For-Profit Hospital?

Joint with Mireille Jacobson

2.1 Introduction

About a fifth of all U.S. corporations have not-for-profit status (Philipson and Posner, 2006). Not-for-profits include organizations as diverse as museums, religious institutions, universities, and hospitals. They share tax-exempt status and can raise capital in the form of private (tax-deductible) donations. But, they cannot issue equity or disburse any net revenues to employees or owners. Indeed not-for-profits have no owners but rather are run by self-perpetuating nonprofit boards (Glaeser, 2003). Not-for-profits are common in markets characterized by asymmetric information and, in particular, ones in which the consumer is ill-equipped to judge the quality or quantity of services provided (Hansmann, 1996). One implication is that for-profits may underprovide the quality or quantity of services. Tax subsidies are then justified as a means to counter underprovision by the private market (Hansmann, 1981).

In this paper, we explicitly model three of the leading theories of not-for profit hospital behavior. We use a unified theoretical framework to model not-for-profit hospitals as: (1) "for-profits in disguise," (2) social welfare maximizers or (3) "perquisite" maximizers. Based on these models, we generate empirically testable predictions of the response of hospital service provision (level and mix) to a large fixed cost shock. We then examine the response of California's hospitals to a large and plausibly exogenous financial shock – a recent, un-funded mandate (SB1953) that requires hundreds of general acute care hospitals in the State to retrofit or rebuild in order to comply with modern seismic safety standards.

Measuring the value of not-for-profit hospitals has proved challenging. In 2006, the Internal Revenue Service conducted a random audit of roughly 500 not-for-profit hospitals to determine how they provide benefits to the community (IRS, 2007). Although not explicitly stated in the report, at issue was what not-for-profits offer in return for their public subsidy.[1] While not-for-profit hospitals are charged with providing "community benefits" as a condition of the federal tax exemption, we have no widely accepted metric of community benefits. Prior to 1969, the IRS interpreted community benefits as the provision of care for those not able to pay to the best of a hospital's "financial ability." The community benefit standard has been relaxed successively over time. Today a not-for-profit hospital can comply by "promoting the health of any broad class of persons" (CBO, 2006). Providing charity care or operating an emergency room falls into this category but so does offering community health screening or conducting basic research.

Due in part to ambiguity in the community benefit standard, Congress and state and local policymakers have repeatedly questioned the motives of not-for-profit hospitals (Horwitz, 2006; Schlesinger and Gray, 2006).[2] Why, they ask, do not-for-profit hospitals look more like money-making than charitable institutions? Literatures in economics, sociology, health policy and legal studies have also struggled to understand what not-for-profit hospitals do and how they contribute to social welfare. While theories of not-for-profit hospitals abound, they typically lay out general mo-

[1]Estimates from the Joint Committee on Taxation put the 2002 value of this subsidy, as measured by federal, state and local tax exemptions, at $12.6 billion (CBO, 2006).

[2]Recently, Senator Charles Grassley (R-Iowa) proposed that Congress mandate a minimum level of charity care that not-for-profit hospitals must provide to qualify for federal tax-exempt status. And hospitals in at least one state, Illinois, have been stripped of their tax-exempt status because they were not providing "enough" charity care (Francis, 2007).

tivations or mechanisms without specifying a formal structure, making it difficult to generate empirically testable predictions of most models. Furthermore the interaction of a hospital's budget constraint with any change in incentives means that strong assumptions on the form of the firm's objective function are required to generate testable implications. As described in Pauly (1987), "The presence of profit in the budget constraint means that all the variables which affect profits appear in the comparative statics of [models of not-for-profit behavior]... Since the same variables with the same predicted signs show up in all models, it is obviously impossible to distinguish among them on this basis." Finally, distinguishing among models of not-for-profit behavior is complicated by the fact that hospitals have some choice over ownership status (David, 2007).

The majority of hospitals in California were built between 1940 and 1970, well before the development of these standards or a sophisticated understanding of seismic safety. Thus, a hospital's cost of compliance is plausibly exogenously predetermined by its underlying geologic risk factors. As support for this claim, we present evidence that within counties seismic risk, a key determinant of the fixed cost shock, is uncorrelated with various neighborhood demographics, such as median household income, or baseline hospital characteristics, such as not-for-profit status. Importantly, because of the long timeframe of new hospital construction (upwards of ten years), the varying cost of compliance determined by seismic risk represents a shock to a hospital's budget constraint with no change in a hospital's production function. Moreover, in contrast to most previous studies of not-for-profit behavior, our source of variation affects a firm's budget constraint without changing its incentive structure. Consequently, we do not have to deal with contemporaneous changes in a firm's incentives and budget constraint. We can thus generate and test falsifiable predictions of hospital behavior using models that make far fewer assumptions than those typically used to study not-for-profit hospital behavior.

We find that a hospital's seismic risk, as measured by the maximum ground acceleration expected with a 10 percent probability in the next 50 years, strongly predicts the probability of hospital closure post-mandate. This response does not differ by ownership type. We also find that increased exposure to SB1953 decreases the probability that a hospital converts its ownership status, irrespective of initial type. Although this first set of results cannot distinguish among our competing hypotheses without the addition of substantial functional form restrictions, they allow us to reject the hypothesis that, relative to for-profits, not-for-profit hospital performance is severely limited by capital constraints. Furthermore, they provide evidence that the mandate has bite.

We then show that hospitals with higher seismic risk spend more on plant, property and equipment between 1997 and 2005. We estimate that a one-standard deviation increase in seismic risk is associated with a $300 million increase in spending on plant, property and equipment over this period. The increase comes largely from improvements in leaseholds, and the purchase of major new equipment. It is concentrated among not-for-profit hospitals, which may reflect differences in the dynamic response to the mandate.

Next we study the impact of seismic risk on changes in resource utilization and service provision. Here we find that a hospital's ownership status (for-profit, private not-for-profit, or government-owned) has very strong and differential effects on its response to the fixed cost shock of SB1953. As predicted by standard theory, for-profit hospitals do not change their service level or mix in response to the fixed-cost shock. In contrast, private not-for-profit hospitals respond by increasing their provision of profitable services (e.g., neonatal intensive care and MRI minutes). In other words, consistent with much of the prior literature (Gruber, 1994; Cutler and Horwitz, 2000; Duggan, 2002; Horwitz and Nichols, 2007), we find that increased competition reduces the difference between private hospitals by forcing not-for-profits to act more like their for-profit peers. Theoretically these results are consistent with the private not-for-profit hospitals as perquisite-maximizing firms and allow us to reject theories of not-for-profit hospitals as either "for-profits in disguise" or purely altruistic entities.

Government-owned hospitals meanwhile respond largely by cutting uncompensated care, as measured by both GAC days and clinic visits for indigent patients.

This behavior is most consistent with the predictions of welfare maximizing models of hospital behavior. Given the debate over whether these hospitals are subject to a binding budget constraint, we remain somewhat cautious about the precise nature of the government hospitals' maximand. However, our own results on hospital closure indicate that the financial shock of SB1953 is large enough to exceed the governement's ability to fully shielded its hospitals. This implies that the budget constraint for these hospitals has some bite and lends credence to interpreting their maximand as welfare. But even if welfare is the proper maximand, we cannot draw strong conclusions about the relative welfare provided by government and private profit-maximizing hospitals. As described in Hart et al. (1997), government-owned firms, lacking incentives to reduce costs, may generate welfare losses due to cost-inefficiencies that outweigh the benefits of their altruistic goals.

On net, these results suggest that both ownership (government vs. private) and organizational structure (for-profit vs. not-for-profit) are important factors in determining hospital response to policy changes. Our results imply that the subsidies provided to not-for-profit hospitals allow them to pursue higher "quality" of services at the expense of quantity. Whether this tradeoff leads to an increase in welfare is theoretically ambigious; additional data on outcomes and long term spillovers would be required to make such a determination.[3] Assuming government-owned hospitals are inefficient even if altruisitic, not-for-profits may represent the second-best solution to meeting our health care needs.

Finally, our results also shed light on the hidden (indirect) cost of California's seismic retrofit mandate, SB1953. In addition to imposing direct costs associated with retrofitting or rebuilding, California's mandate has decreased both the number of hospitals in the State and the provision of uncompensated care by government-owned hospitals.

[3]For example, as is discussed in the medical literature, teaching hospitals face a conflict between providing health care services now and ensuring a sufficient supply of well trained doctors in the future. Moreover, overinvestment in new technologies (i.e. early adoption by some hospitals) may lead to technological spillover and improvements in healthcare provision in all types of hospitals.

2.2 Literature Review

A vast literature, both theoretical and empirical, seeks to understand the objectives of not-for-profit hospitals. We divide this literature into three broad categories: (1) "for-profits in disguise," (2) social welfare maximizers and (3) "perquisite" maximizers.[4]

The not-for-profits as "for-profits in-disguise" (hereafter FPID) hypothesis implies that hospitals masquerade as charitable organizations but, in fact, operate as profit maximizing entities (Weisbrod, 1988). This could occur because of either lack of enforcement or ambiguity in the legal requirements to qualify as tax-exempt.[5] A large empirical literature has tried to look for differences in the equilibrium behavior of for-profit and not-for-profit firms.[6] An early example of such a paper, Sloan and Vraciu (1983) compares costs, patient mix, and quality across non-teaching for-profit and not-for-profit hospitals in Florida. The authors find no differences in after-tax profit margins, the share of Medicare and Medicaid patient days, the value of charity care, and bad debt adjustments to revenue. They find some small differences in service mix but none vary systematically across profitable versus nonprofitable services. They conclude that all hospitals, regardless of ownership type, are forced to balance social objectives and financial considerations.

Where, like Sloan and Vraciu (1983), others have found little or no difference in costs, profitability, pricing patterns, the provision of uncompensated care, the quality of care or the diffusion of technology across ownership type, they conclude that not-for-profit hospitals behave no differently than their for-profit counterparts (e.g., see Becker and Sloan, 1985; Gaumer, 1986; Shortell and Hughes, 1988; Keeler et al., 1992;

[4]Our classification system differs from much of the recent literature, (e.g., Silverman and Skinner (2004), which adopts the taxonomy in Malani et al. (2003)). Malani et al. (2003) effectively distinguishes among four class of models – 'for-profits in disguise," "altruism," "physician cooperatives," and "non-contractible quality." Our taxonomy defines three categories but the final category – "the perquisite maximizers" – captures several alternate models of hospital behavior including physician cooperatives (Pauly and Redisch, 1973; Young, 1981), mission-driven hospitals and prestige maximizers (Newhouse, 1970). All our models allow for some aspect of "non-contractible quality" as opposed to treating it as a separate class of models.

[5]Why in such a world would not all hospitals obtain not-for-profit status to take advantage of the tax benefits? Some may have higher masquerading costs. Others may require broader access to capital than is available to not-for-profits. Switching costs, e.g. regulatory friction, may be high. And some may have difficulty extracting super-ordinary excess profits.

[6]Sloan (2000) provides an extensive review of the literature.

Norton and Staiger, 1994; McClellan and Staiger, 2000; Sloan et al., 2001; Schlesinger and Gray, 2003). Duggan (2000), which improves on the earlier literature by studying differential responsiveness to a *change* in the financial incentives to treat indigent patients in California, finds that the important behavioral distinction is between public and private hospitals regardless of not-for-profit status.[7] To the extent that hospitals share the same costs, quality, and service mix (including uncompensated care), the implication is that either (1) not-for-profits are profit-maximizers or (2) competition is so intense that not-for-profits are forced to subvert their altruistic objectives to survive (Sloan and Vraciu, 1983). In so far as some papers (e.g., Gruber, 1994; Cutler and Horwitz, 2000; Duggan, 2002; Horwitz and Nichols, 2007) have shown that when competition increases, not-for-profits change their behavior to more closely match their for-profit peers, the latter hypothesis cannot be broadly applicable to the hospital industry.

A second class of models we consider posits that hospitals maximize some measure of social welfare. The usual justification given for these preferences is a taste for altruism or social welfare. For instance, altruistic managers and employees may sort into not-for-profit firms (Rose-Akerman 1996, Besley and Ghatak 2004). They use the tax advantage from non-profit status to address unsatisfied demand for government-funded provision of certain public goods and may accept lower wages to further cross-subsidize the provision of public goods. Alternatively, welfare maximizing not-for-profit firms might occur as a socially optimal response to asymmetric information (Arrow, 1963; Nelson and Kashinsky, 1973; Easley and OHara 1983; Hansmann 1980; Weisbrod, 1978; Weisbrod and Schlesinger, 1986; Hirth, 1999; Glaeser and Shleifer, 2001). In other words, firms may use not-for-profit status to commit themselves to provide quality by constraining their own incentives to reduce (unobserved and noncontractible) quality in favor of profits. Empirical support for this hypothesis

[7]The literature on behavioral differences between not-for-profit and for-profit hospitals is quite mixed. To our reading, most find no differences. But, several find that not-for-profits provide more unprofitable services (Schlesinger et al., 1997; Horwitz, 2005)or higher quality care (Shen, 2002), employ fewer performance bonuses in executive compensation (Erus and Weisbrod, 2003), have lower marginal costs but higher markups (Gaynor and Vogt, 2003) and engage in less upcoding (Silverman and Skinner, 2003; Dafny, 2005).

is largely based on the literature showing that not-for-profit hospitals provide more charity and subsidized care than their for-profit peers (Schlesinger et al., 1987; Frank et al., 1990; Mann et al., 1995; Clement et al., 2002; Horwitz, 2005).

The final class of models studied here assumes that not-for-profit hospitals maximize something other than profit or social welfare. It thus covers a wide range of theories. Newhouse (1970) is the starting point for this group. That work suggests that not-for-profit hospitals maximize "prestige", a weighted average of quality and quantity, subject to a break-even or zero profit constraint (Newhouse, 1970). That is hospitals have a taste for quality and quantity that distorts their production away from both profit and welfare maximization.[8] Alternatively, not-for-profit hospitals may compete with each other to gain public goodwill (Frank and Salkever 1991). In what they term a model of impure altruism, hospitals aim to provide quality (length of stay or intensity of services) to indigent patients that is similar to that of their rivals.[9] This type of model may capture a quasi-altruistic motive: hospitals take not-for-profit status to financially support the provision of high quality care (Newhouse, 1970; Lakdawalla and Philipson, 1998).

These variants of perquisite maximization can be seen as part of the CEO empire building literature in finance (e.g., see Hart, 1991; Grossman and Hart, 1982; Jensen, 1986 or Shleifer and Vishny, 1991) or may be the result of "mission driven" firms, whose goals, though perhaps altruistic in origin, create inefficiencies in heath care production.[10] As a very simple example, a firm that attempts to fulfill a mission of

[8]As discussed in Newhouse (1970), since the pursuit of profit maximization can lead to under-provision of both quality and quantity, a hospital's taste for quality and quantity can lead to welfare improvements.

[9]Frank and Salkever (1991) note that if not-for-profits maximize social welfare, they should care about the total volume of charitable care not their own provision of such care. Finding little evidence of either crowding out or large income effects, they posit the model of impure altruism.

[10]Historically not-for-profit hospitals were charitable organizations created to provide care for the poor (Willard 1989). While many not-for-profit hospitals now have missions to provide "cost effective" care to the community at large, some have more specific or multifaceted goals. For example Florida Hospital's mission statement begins,"Our first responsibility as a Christian hospital is to extend the healing ministry of Christ to all patients who come to us." Barnes Jewish Hospital's mission statement declares that it is "committed to optimizing the quality of care the patients receive in our health care environment and to implement changes toward that effect." Representative of the multifaceted goals of teaching hospitals, Beth Israel Deaconess Medical Center's mission is to "serve patients, students, science and our community."

providing "only the highest level of care" may consequently provide an inefficiently high level of quality and treat an inefficiently low number of patients.

Models in this category need not have any quasi-altruistic motivation. As an example, Pauly and Redisch (1973) model not-for-profit hospitals as physician cooperatives. Organizing as a cooperative frees physicians of the demands of outside investors and allows them to assume control over resource allocation. The physicians then make input and output decisions so as to maximize net individual income, distorting their behavior away from efficient production. Specifically, because of the incentives generated by this organizational structure, physicians distort their production process to include more perquisites (e.g. overinvestment in capacity or technology) to maximize their individual utility.

2.3 Models

We begin by modeling these three categories of not-for-profit hospital behavior. The first model assumes that not-for-profit hospitals are simply "for-profits in disguise" (Weisbrod 1988). Corresponding to a simple model of a profit maximizing firm, it serves as the basis for our subsequent models. Our second model corresponds to the idea of not-for-profit hospitals as purely altruistic firms that have as their maximand some weighted version of social welfare. In our third and final model, not-for-profit hospitals maximize perquisites.

2.3.1 The Basic Model

Hospitals are assumed to maximize an objective function

$$V = V(R, P, u) \tag{2.1}$$

subject to a break-even constraint

$$R = \pi(q, Q) - P - u + F \geq 0 \tag{2.2}$$

where R is net revenue, P are non-pecuniary perquisites, Q is the "quality" of compensated care, u is the amount of uncompensated (indigent) care, and F is a fixed cost shock. Our use of the term "quality" is somewhat unusual. Much of the literature treats quality as a characteristic of care that is positively correlated with the welfare provided by a given procedure. As will hopefully become clear, we treat quality in more general terms as *any* characteristic of care that distorts costs, regardless of whether its welfare-improving. As a rather unlikely example of a quality improvement that does not improve welfare, imagine providing surgeons with disposable solid gold scalpels. These scalpels would increase the cost of surgery without increasing the welfare provided to the patient undergoing surgery. More realistically, surgeons may prefer and thus perquisite-maximizing hospitals may provide an expensive brand of scalpels that provides no additional health benefits to patients.

We make the standard assumption that perquisites are inferior to cash.[11] In addition, we assume that hospitals are price-takers with access to similar production technologies.[12] The assumption of access to the same technologies does not require that all hospital have identical production functions but rather that the cost functions for each hospital meets the first order conditions described later in this section.

Profit can be simply expressed as the difference between the quantity of profitable services produced (q) and a cost function convex in q and increasing in quality Q:

[11] In addition to the usual argument that goods-in-kind are weakly inferior to cash since one could always purchase the perquisites, this assumption can also be the result of intrinsic frictions or other costs of transforming cash into perquisites (e.g. the cost of circumventing detection). The IRS's 2004-2006 Executive Compensation Compliance Initiative report acknowledges the importance of perquisites for not-for-profit hospitals, identifying the practice of providing "insiders" with loans and unreported "fringe benefits" as particularly problematic.

[12] Importantly, the basic results of our models are *not* driven by the price-taking assumption. However, given the high degree of price regulation and the dominance of large private and public insurers this is the standard assumption in much of the literature. See Frank and Salkever (1991) for further discussion on this topic.

$$\pi(q,Q) = pq - C(q,Q) = pq - \int_0^q c(x) + Qdx \tag{2.3}$$

where the marginal cost function $c(q)$ is continuous, differentiable and increasing in its argument ($c_q \geq 0$) and Q is the per unit spending on increased quality. Hereafter WLOG we normalize the price p for a unit of profitable service to 1.

The timing of hospital behavior, as it corresponds to the natural experiment we study below, can be thought of as follows:

1. Hospitals choose q, Q, R, u to maximize $V(R, P, u)$ subject to their budget constraint $R = \pi(q, Q) - P - u \geq 0$.
2. Hospitals receive a fixed cost shock F.
3. Hospitals choose q', Q', R', u' to maximize $V(R, P, u)$ subject to their new budget constraint $R = \pi(q, Q) - P - u + F \geq 0$.
4. If a hospital is unable to meet its budget constraint, it shuts down.

2.3.2 Profit Maximization

Since perquisites necessarily reduce profits, a profit maximizing hospital will choose to have no perquisites (i.e. corner solution P=0). The notion behind FPID is the idea that restrictions on the operations of not-for-profit hospitals are not binding and that they are de-facto operating as for-profit institutions. In terms of our model, this has three implications. First since perquisites are inferior to cash (i.e. $V_R \geq V_P$), the hospital will choose the corner solution $P = 0$. Second since the maximand R is decreasing in Q, FPID firms will set $Q = 0$. Third since uncompensated care simply reduces revenue one-for-one, hospitals will also not provide any uncompensated care, $u = 0$.[13]

[13]Empirically for-profit hospitals provide a non-zero level of indigent care. The most common reasons given for this somewhat unexpected fact is that such charitable actions engender goodwill. Therefore, as with quality, values of zero for indigent care should be thought of as mapping to some minimum non-zero amount of indigent care a hospital must, for whatever reason, provide.

Setting $P = Q = u = 0$, normalizing output prices to one, and substituting equations (2.2) and (2.3) into (2.1), the firms objective function can be rewritten as $V(q, Q|F) = V(\pi(q, Q) - F) = V(\int_0^q (1 - c(x))dx - F)$. The first order condition is then simply

$$\frac{dV}{dq} = V_R(1 - c(q, Q)) = 0 \tag{2.4}$$

Since R is a normal good, $V_R > 0$ so equation 2.4 requires that $R_q = 0$ and $q^* = c^{-1}(1)$. As expected, for-profit firms simply produce q until the marginal cost equals the price and quantity q^* is independent of the fixed cost shock F. So the production behavior of a profit maximizing firm is unaffected by fixed cost shocks. So we would expect both the level and mix of services provided by a FPID to be unaffected by a fixed cost shock.[14]

Though both obvious and expected, this prediction is quite important for two reasons. First it provides us with a very basic 'gut' check of the external validity of our model and the credibility of our research design. That is if the behavior of for-profit hospitals are markedly different from that predicted in our model, it would give us serious pause regarding either the applicability of the standard neo-classical model or the validity of our natural experiment as a fixed cost shock.

Second it illustrates the advantage of the fixed shock approach; it is robust to both the specific form of the objective function and the level of any of the parameters. That is although the level of services may vary with local conditions, the sign of the change in levels does not. For example even if FPID firms have different cost than for-profits or specify that not-for-profit hospitals are located in fundamentally different markets than their for-profit peers, the model's predictions remain unchanged.

[14]The obvious exception is if the hospital is unable to meet its budget constraint and must shut down (i.e. zero services).

2.3.3 Altruism

An alternative model of not-for-profit behavior posits that hospitals maximize not profit, but rather some measure of social welfare.[15] An important component of most models of not-for-profits as welfare maximizers is the idea that not-for-profits provide higher "quality" than a purely profit maximizing firm. The idea behind this is that for many health services, quality Q, which is costly to the firm, is both welfare increasing and non-contractable. The non-contractibility of this additional socially efficient quality improvement means that profit-maximizing firms will not provide it since the increased cost is not offset by a countervailing increase in payment. An altruistic firm though would prefer to provide Q if it increases the total welfare generated by the hospital.

In terms of our model we incorporate this idea of welfare maximization by simply defining welfare as a perquisite P. Specifically for an altruistic firm we define $P = W$ where W is simply the sum of the welfare provided to each person who receives a unit of healthcare q: $W = q(\omega + g(Q)$ where ω is the "base" level of welfare provided by q and $g(Q)$ is the additional welfare provided by each dollar spent on higher Q. $g(Q)$ is assumted to be weakly increasing and concave ($g'(Q) \geq 0$, $g''(Q) < 0$) with $g(0) = 0$ and $g'(0) < \omega$.[16]

Altruistic firms can then be thought of as having a demand function for two normal goods $\{q, Q\}$; that is demand for both quality and quantity are non-decreasing in wealth. That altruistic hospitals do not value quality in and of itself, but rather as a vehicle for providing better care to patients is straightforward but, as discussed in the next section, is also key for distinguishing between altruisitic and perquisite

[15]The literature generally conceives of this occurring through altruistically motivated managers or agents. See for example Rose-Ackerman 1996, Frank and Salkever 1991 or Besley and Ghatak 2004.

[16]Intuitively the final assumption requires there to be no non-contractable elements of quality that would provide large welfare gains to consumers at a low per unit cost. This assumption is largely benign and is included largely to allow us to expositionally ignore firm behavior in a small region near the boundry condition $Q = 0$. Specifically since g is a positive concave function, we know that the condition $g'(Q) < \omega + g(Q)$ must be true for $Q > \underline{Q}$ where $\underline{Q} < 1 - \frac{\omega}{g'(Q)}$. Then since $g(0) = 0$, this means that this second condition can be violated if and only if $g'(0) > \omega$ and then only for the range $Q \in (0, \underline{Q})$.

maximizing firms.

An altruistic hospital's objective function can be thought of as a function of the social surplus generated by providing uncompensated care u and compensated care q with quality $Q \geq 0$. This implies that $R = 0$, independent of a binding non-distribution constraint; altruistic hospitals preference is to transform any surplus into more or better health services. Setting $R = 0$ and substituting $P = W = q(\omega + g(Q))$ into (2.1), the firm's objective function can be rewritten as $V = V(q(\omega + g(Q)), \pi(q, Q) + F)$. The first order conditions are then:

$$\frac{dV}{dq} = V_P(\omega + g(Q)) + V_u \pi_q(q, Q) = 0 \tag{2.5}$$

$$\frac{dV}{dQ} = V_P q g_Q(Q) + V_u \pi_Q(q, Q) = 0 \tag{2.6}$$

Since V_P, V_u and $g(Q)$ all have positive values, (2.5) requires that $\pi_q = 1 - c(q, Q) < 0$. This means that, controlling for quality, altruistic hospitals will "over-produce" relative to for-profit firms by continuing to provide units of q even after marginal cost exceeds price. In addition, in response to a positive fixed cost shock F, altruistic hospitals will weakly increase q, Q and u as determined by our first order conditions. Intuitively because altruistic hospitals have a preference for q, Q and u, they will spend any "extra" money on weakly increasing all three goods. Borrowing terminology from consumer demand theory, we can recast the problem as that of an individual choosing a consumption bundle $\{q, Q, u\}$ for three normal goods where prices for two of the goods (q, Q) are are both increasing in q and Q. Let $\{q^*, Q^*, u^*\}$ be the chosen bundle for wealth $W \leq \pi$. If wealth is increased to $W' = W + F > W$ then for the new bundle choice $\{q', Q', u'\}$ must be weakly greater in each good (i.e. $q' \geq q^*, Q' \geq Q^*, u' \geq u^*$).

Note that overproduction is defined relative to a profit-maximizing firm. But in this context the profit-maximizing quantity is not socially optimal. In terms of our natural experiment, this model predicts that altruistic not-for-profits should decrease their provision of profitable services, the quality of service and uncompensated care in response to the negative financial shock imposed by the seismic retrofit mandate. That is since altruistic hospitals use their revenue to subsidize the production of excess quantity q, quality Q, and uncompensated care u, they will be less able to subsidize these activities when faced with a negative fixed cost shock and will (weakly) reduce production along all three dimensions.

2.3.4 Perquisite Maximization

Our final model of not-for-profit hospital behavior follows from the observation that a binding non-distribution constraint will lead a not-for-profit firm to disburse profits through non-pecuniary perquisites (see Glaeser and Shleifer 2001).[17] Because our fixed cost shock policy experiment allows us to be quite general as to the specific structural form of the distortion, we will remain largely agnostic as to the exact nature of the perquisites. Instead we will simply model perquisites as something consumed by the hospital that can increase the cost of producing units of q. Perquisites that raise the cost of production correspond in our model to valuing quality Q. In contrast to the previous model, here quality is valued in and of itself and not as an input into increasing the value of units of q. That is for perquisite maximizing hospitals "quality" is itself a desired good, whereas altruistic hospitals have a preference for total welfare, which is jointly determined by quantity and quality. Perquisites that do not affect production correspond to a taste for R. Note that if none of the perquisites raise the cost of production, the model reduces to the FPID case.

In the context of health care, quality is usually thought of as a vertical feature of health care (i.e. it increases a patients willingness-to-pay (WTP) for a unit of q). In our model quality should instead be thought of as any characteristic of that distorts the cost function regardless of whether or not it affects a recepient's WTP.

[17]We will assume for simplicity that perquisite maximizing firms do not care about providing uncompensated care (i.e. $u = 0$). Note though that this is solely for the purposes of expositional simplicity as any of our results would hold by simply re-labeling uncompensated care as a perquisite.

We assume $P = f(Q)$ where $f(\bullet)$ makes Q as perquisite is increasing and concave in V (i.e. $f_Q > 0$ and $V_P P_{QQ} + V_{PQ} P_Q < 0$).

The canonical example of a perquisite in the corporate finance literature is the case of managers providing themselves with excessively luxurious work environments (i.e. nice offices, corporate jets, \$15,000 umbrella stands).[18] In this example the nice office would be considered a non-distortionary perquisite since it does not change the cost of production. A corporate jet though would be considered a distortionary perquisite (P) since it presumably increases the cost of travel relative to commercial air travel. Note that in both examples the increase in Q is not likely to affect the end consumers WTP. In a hospital setting, the pursuit of these "selfish," (i.e., non-vertical quality increasing) perquisites might correspond to overinvestment in capital and capacity in ways both distortionary and non-distortionary in nature.[19]

In the context of hospitals, behavior may be driven by preference for many less frivolous perquisites. Perquisites could arise if hospitals pursue a "mission" other than maximization of social welfare. For example, a hospital that wants a reputation as the "best" or providing "only the highest quality care," may overprovide vertical quality at the expense of total welfare. Another example of a not-for-profit hospital mission is that of teaching hospitals. If a hospital cares about training high quality doctors, they might pursue quality teaching even at the expense of current welfare or profits.[20] Alternatively, some hospitals may have a preference for treating the most technically difficult or challenging cases and go so far as to bring in a few patients from abroad at the expense of many local patients.

Setting $u = 0$, a perquisite maximizing firm's objective function can be written as $V = V(\pi(q, Q) + F, f(Q)))$. Taking first order conditions we get

[18]The \$15,000 umbrella stand, along with a \$6,000 shower curtain and a \$2 million birthday party for his wife were some of the more unusual perks received by L. Dennis Kozlowski, the former chief executive officer of Tyco who was eventually convicted of misappropriating \$400 million in company funds

[19]This is often cited in the context of physician cooperatives (Pauly and Redisch, 1973).

[20]Since this preference for teaching might reasonably be seen as an attempt to maximize some multi-period welfare function, this example reminds us that additional data on health outcomes is required before a normative analysis of the welfare implications of these models can be attempted. This issue is discussed in more detail in the results section of this paper.

$$\frac{dV}{dq} = V_R(1 - c(q, Q)) = 0 \tag{2.7}$$

$$\frac{dV}{dQ} = V_R(\pi_Q) + V_P f'(Q) = 0. \tag{2.8}$$

Since $V_R > 0$, from(2.7) we find that, conditional on quality Q, perquisite seeking firms will produce q until marginal cost equals marginal revenue so q^* is fully determined by the hospital's choice of Q^*. This makes intuitive sense since producing any other quantity would simply reduce firm profits, profits that could otherwise be used to pay for more perquisites $\{R, P\}$.

Rearranging (2.8), we can express $V_R = \frac{V_P f'(Q)}{-\pi_Q}$. From the budget constraint, we can conclude that an increase in F leads to an increase in R. From the concavity of V with respect to R, this implies that V_R is decreasing in F. On the right hand side, the numerator $V_P f'(Q)$ is decreasing in Q, while the denominator $-\pi_Q$ is increasing in Q so the expression on the right hand side is decreasing in Q. An increase in F will then lead to an increase in Q.

Returning to our consumer demand theory analogy, Q and R are normal goods where the price of R is 1 and the price of Q is increasing in Q. Q and R will then both weakly increase with increases in wealth (i.e. F). That is a positive shock F means firms can afford more of each desired good. The intuition is again simply that when the budget constraint is loosened, firms are able to afford a larger distortion of their production away from the profit maximizing quantity/quality mix to better meet their preferences. Since profitable services q are negatively related to Q, the increase in Q results in a decrease in production q. In terms of our natural experiment, a large negative fixed cost shock should cause a perquisite maximizing hospitals to increase their provision of profitable services, q, and have no effect on uncompensated care.

It should be noted that although perquisite seeking hospitals obviously fall short of altruistic hospitals in terms of generating welfare, the welfare implication of this distortion relative to the profit maximizing case is theoretically ambiguous. Moreover, while a negative fixed cost shock and increased competition decrease the total welfare generated by altruistic firms, the welfare implications for a prestige-maximixing firm can only be determined with additional functional form assumptions.

2.3.5 Summary of Predictions

Table 2-II summarizes the predicted responses to a fixed cost shock implied by each of our three classes of models. For FPID, we expect no change in service provision or quality in response to this shock. In comparison the altruistic model predicts a decrease in profitable care, uncompensated care and quality in response to a fixed cost shock. We can further distinguish perquisite maximizing hospitals based on the prediction that they should increase the provision of profitable services and decrease quality following a negative fixed cost shock. Unfortunately we do not have good measures of quality. Nonetheless, the predictions on the quantity of profitable and uncompensated care are sufficient to distinguish across our three classes of models. In the next section we describe a natural experiment that allows us to test these different predictions.

2.4 The Program: California's Seismic Retrofit Mandate

California's original hospital seismic safety code, The Alquist Hospital Facilities Seismic Safety Act, was enacted in 1973. Prompted by the 1971 San Fernando Valley earthquake, which destroyed several hospitals, the Alquist Act required newly constructed hospitals to follow stringent seismic safety guidelines. Perhaps in response to these requirements and despite the state's aging healthcare infrastructure, hospital construction projects remained rare throughout the 1980s (Meade and Kulick, 2007).[21]

On January 17, 1994 at 4:30am a 6.7 magnitude earthquake hit 20 miles northwest

[21] A state-sponsored engineering survey of all hospitals found that by 1990 over 83 percent of hospital beds were in buildings that did not comply with the 1973 Alquist Act (Meade et al. 2002).

of Los Angeles, near the community of Northridge.[22] The 1994 Northridge earthquake caused billions of dollars in damage and left several area hospitals unusable.[23] Damage extended as far as 85 miles away from the epicenter. In its wake, California amended the Alquist Act to mandate a timeline by which all general acute care (GAC) hospitals must demonstrate that their facilities can both withstand and remain operational following a major seismic event. No money has been earmarked to aid in this process.

Although the amendment, SB 1953, was passed quickly, its requirements were only finalized in March of 1998, after approval by the California Building Standards Commission.[24] SB 1953's primary innovation was to establish deadlines by which all GAC hospitals had to meet certain seismic safety requirements or be removed from operation (see Table 2-I). Its ultimate goal was to enable hospitals to remain operational following a strong earthquake so as to maintain current patients and provide care to earthquake victims. The deadlines were to offer hospitals a "phased" approach to compliance (Meade and Kulick, 2007).

The first deadline facing GAC hospitals was January 2001. By that date, all GAC hospitals were to submit a survey of the seismic vulnerability of each of its buildings. Most hospitals (over 90%) complied with this requirement (Alesch and Petak, 2004). As part of the survey, each hospital classified the nonstructural elements (e.g. power generators, communication systems, bulk medical gas, etc.) in each of its buildings according to five "Non-structural Performance Categories" (NPC). Similarly, the structural support in each building was rated according to five "Structural Performance Categories" (SPC). These ratings indicate how a hospital should fare in a strong earthquake (OSHPD, 2001). Table 2-I describes the full set of SPC ratings. Broadly, the first categories, both NPC-1 and SPC-1, represent the worst and the last categories, NPC-5 and SPC-5, the best ratings.

About 70 percent of hospital buildings were in the NPC-1 category (Meade et

[22] http://earthquake.usgs.gov/regional/states/events/1994_01_17.php

[23] According to the California Hospital Association, 23 hospitals had to suspend some or all services. See http://www.calhealth.org/public/press/Article%5C103%5CSB1953factsheet%20-%20Final.pdf Six facilities had to evacuate within hours of the earthquake (Schultz et al. 2003). But no hospitals collapsed and those built according to the specifications of the Alquist Act suffered comparatively little damage.

[24] See http://www.oshpd.state.ca.us/FDD/SB1953/index.htm.

al. 2002). This rating indicates that major non-structural elements essential for providing life-saving care are not adequately braced to withstand a major earthquake. Hospitals faced a January 1, 2002 deadline for bracing these systems, shifting their NPC-1 buildings to the NPC-2 rating. While we know of no estimates of the costs of compliance, this requirement was viewed as a relatively minor aspect of the law.[25]

The first major deadline facing California hospitals was January 2008 (or January 2013 with an extension). By this date, all hospitals with SPC-1 buildings were to have retrofitted to remain standing following a strong earthquake or taken out of operation. Based on the initial ratings, about 40 percent of hospital buildings or 52.4 million square feet of floor space was SPC-1 (Meade and Kulick, 2007). Expressed in terms of beds, about 50 percent were in the lowest compliance category of buildings. Only 99 hospitals in California or about 20 percent of the 2001 total had no SPC-1 buildings and were thereby in compliance with the 2008 requirements (Meade et al., 2002).

The final deadline facing GAC hospitals is January 1, 2030. By 2030, all SPC-1 and SPC-2 buildings must be replaced or upgraded. The upgraded buildings will be usable following strong ground motion. While the legislature thought that hospitals would retrofit SPC-1 buildings, upgrading them to SPC-2 status by 2008/2013, and then replace them completely by 2030, few hospitals have gone this route. Rather, to avoid the expense and disruption of a retrofit, most hospitals with SPC-1 buildings have chosen to rebuild from the outset, effectively moving the final deadline up from 2030 to 2008 or 2013, if granted an extension, and causing an unprecedented growth in demand for hospital construction (Meade and Kulick, 2007).

Recognizing that most hospitals would not meet the 2008/2013 deadlines and that the original SPC ratings were based on crude assessments, the Office of Statewide Health Planning and Development (OSHPD) recently (on November 14, 2007) authorized a voluntary program allowing hospitals with SPC-1 buildings to use a "state-of-the-art" technology called HAZUS (Hazards U.S. Multi-Hazard) to re-evaluate their

[25]RAND estimated the total cost of compliance with this requirement at about $42 million. In contrast, their initial estimate of the cost of reconstructing SPC 1 buildings was about three orders of magnitude higher, at $41.1 billion (Meade et al. 2002).

seismic risk.[26] Hospitals that opt into the program must submit a written request along with their seismic evaluation report and a supplemental report identifying where the original ratings may have been inaccurate. Participation in the program effectively moves the compliance deadline to 2013, if any buildings are still deemed SPC-1, or to 2030, if all buildings are reclassified as SPC-2, meaning they can withstand a major earthquake but may not be functional afterwards. Despite the extensions and reclassifications, most hospitals in the State are already or will soon be engaging in major near-term capital investment projects.

Figure 1 shows the mean and median value of hospital construction in progress since 1996. After 2001, the year hospitals had to submit their building surveys, the mean value of construction in progress rose sharply, from $5.5 to almost $14 million (in 2005 terms). Some of this increase must reflect the national increase in construction costs as well as the specific increase in health care construction costs in California. But even the California Health Care Association's claim of a 57 percent increase in the cost of hospital construction between 1995 and 2005 (Langdon 2006), cannot fully explain the roughly 150 percent growth in the value of construction in progress that occurred over a similar period. As suggested by the exceptionally long wait times to book specialized health care construction firms, much of the growth is due to an increase in construction projects.

Figure 1 also reveals a big discrepancy between trends in the median and mean value of construction spending. While median construction spending also picked up in 2001, the trend was clearly upward between 1996 and 2001. More importantly, however, the median value is well below the mean. The large difference between the mean and median value of construction in progress implies that a few hospitals are spending a lot on construction while the typical hospital is spending much less. This disparity is congruent with the idea that there is no break in trend for hospitals in general. Rather, the increase in spending is driven by those hospitals disproportionately affected by the seismic retrofit mandate. Indeed in the work that follows, we find, among other things, that differential exposure to the mandate predicts differences in

[26]See http://www.oshpd.ca.gov/fdd/sb1953/FinalJan2008Bul.PDF

spending on plant, property and equipment.[27]

2.5 Data and Methods

2.5.1 Data Sources

To assess the impact of California's seismic retrofit mandate, we combine data on the seismic risk, service provision, and finances of all general acute care hospitals in the state of California. Data on finances are from the Office of Statewide Health Planning and Development's Annual Hospital Disclosure Report (AHDR) and are available for 1996 through 2006. All financial data are normalized to 2005 dollars. Most of the service provision data are also from the ADHR. Since the AHDR service provision data are not comparable prior to 2001, we analyze changes between 2002 and 2005 or 2006.[28] We supplement these data with information from OSHPD's Inpatient Hospital Discharge Data files for 1997 and 2005 and from the Annual Utilization Reports, which are less detailed but are available for the years 1992 through 2006. The AUR reports are used to identify hospital closures, which we crosscheck with California Hospital Association's records.[29] License conversion information was obtained through a request to OSHPD.

Seismic ratings and SB 1953 extension requests are all maintained in separate databases by OSHPD. The California Geological Survey (CGS) provided data on the underlying seismic risk of each hospital's location. Specifically, we use a measure called the peak ground acceleration factor, pga, which is the maximum expected ground acceleration that will occur with a 10 percent probability within the next 50

[27] We also compare hospital construction spending in California to private healthcare construction spending in the South Atlantic and private educational spending in the Pacific Division, the lowest level of aggregation available from the Census Bureau's "Manufacturing, Mining and Construction Statistics" (Figure 2). This figure suggests that the sharp increase in hospital construction spending in California starting in 2001 is not driven by underlying industry or region trends.

[28] Based on discussions with OSHPD, we were advised to not use the first year of available service data. That said, results are quite similar if we use 2001 as the base year. In some cases our estimates are more and in others less precisely estimated.

[29] See http://www.calhealth.org/public/press/Article%5C107%5CHospitalclosures.pdf. In placebo checks, we also analyze closures from 1992-1996. These data are cross-checked against reports from the Office of the US Inspector General.

years normalized to Earth's gravity.[30]

2.5.2 Identification Strategy

Together these data can be used to understand how the large increase in expenditures necessitated by SB 1953 impacts a hospital's finances and service provision. The financial burden associated with SB 1953 is largely reflected in a hospital's SPC building ratings. Since these ratings, which reflect both building quality and location, are nonrandom, we cannot simply compare ratings and outcomes. Hospitals in worse financial condition are also likely to have lower ratings.

However, one feature of the SPC ratings is largely predetermined - underlying geologic seismic risk. Most hospitals in the State were built between 1940 and 1970, at a very early stage in our understanding of seismic risk and well before the development of modern seismic safety standards. New construction has been slow relative to estimates of a reasonable building lifespan (Meade et al., 2002). And, although many hospitals have built new additions, most are in their original location (Jones 2004). Many of the new additions have been so well integrated into the original hospital structure that they will need to be replaced along with the older buildings (Jones 2004). Combined with high seismic variability at relatively small distances (e.g., see Appendix Figure 1), the result is that well-performing hospitals are unlikely to have selected into "better" locations (along seismic risk dimensions), at least within a locality.

Our identification strategy relies on the assumption that a hospital building's underlying seismic risk (g) is effectively randomly matched to hospitals within a geographic area (e.g. a county or city). This assumption seems consistent with discussions between the authors and seismologists, who lament the fact that seismic risk is factored into building construction on only a very gross, highly-aggregated level (e.g. by county). This assumption is further corroborated by empirical tests (shown below) of the distribution of observables.

[30]This is a standard way of expressing seismic risk. For more details, see http://www.consrv.ca.gov/cgs/rghm/psha/ofr9608/Pages/index.aspx

2.5.3 Econometric Specifications

Our basic regression specification is:

$$Y_h = pga_h + \beta X_h + \gamma_c + \epsilon_{h,c} \tag{2.9}$$

where Y_h is our outcome of interest, such as spending on plant, property and equipment (PPE) or days of care provided to indigent patients in hospital (h), pga_h is a hospital's inherent seismic risk, as measured by its predicted peak ground acceleration factor, X_h is a hospital's observable characteristics, and γ_c is a county fixed effect. Ideally we would include pre-mandate hospital characteristics as controls since the mandate itself may alter hospital observables. We are able to measure several baseline characteristics as of 1992 – bed size, ownership status (for-profit, not-for-profit, or public), rural status and license age. Due to data limitations, two other control variables – whether the hospital is part of a multi-hospital system and teaching status (whether the hospital has an approved residency program) – are measured as of the 1996 fiscal year, almost two full years prior to the finalization of the mandate's provisions.[31] Since the specifics of the legislation were not finalized until March 1998 and hospitals did not know their full exposure to the legislation until 2000 when their buildings were rated, the risk of endogeneity of the 1996 fiscal year (July 1995-June 1996) hospital characteristics should be minimal.

In order to test for differences in the response of hospitals by ownership type, we run all regressions as (10) and then augment them to include interactions between seismic risk and ownership status (for-profit or public, with not-for-profit the omitted category). It is these interaction terms that allow us to test our models of hospital behavior. If, for example, not-for-profit and for-profit hospitals have similar coefficients (i.e. responses to the fixed cost shock of retrofitting), then we might take it as support for the FPID hypothesis. Alternatively, to the extent that not-for-profit hospitals alone increase the provision of profitable services in response to a fixed cost shock, then we can both reject theories of pure profit-maximization and pure altruism.

[31]The 1992 data are from OSHPD's AUR; 1996 system and teaching status are from the AHDR.

We consider three alternate specifications for our outcome variables. First we look at the simple level of our dependent variables in the most recent year (2005 or 2006). We use the most recent year since it is the closest to the retrofit deadline and should therefore represent the year for which the effect of the legislation is the largest. This intuition is confirmed by evidence from both Meade and Kulick (2007) and our own regressions using the levels of our outcome variable for other years. We find a systematic and largely monotonic increase in the magnitude of the effect of pga on our outcomes as we approach 2006.

Second we sum the levels of each outcome variable for all available years (1996-2006 for spending measures and 2002-2006 for most service measures). These results represent the aggregate effect of the legislation for the entire period of available data. This specification helps avoid the possibility that our results are driven by the idiosyncrasies of any specific year. The results from this specification look very similar to our first specification, but with generally more precisely estimated coefficients.

Finally we take a long difference approach and use the change in levels between 2006 and 1992, 1997 or 2002, depending on the earliest year available for a given measure. Specifically we estimate regressions of the following form:

$$\Delta Y_{hct,t-n} = pga_h + \beta X_{hct,t-n} + \gamma_c + \epsilon_{hct,t-n} \tag{2.10}$$

where $\Delta Y_{hct,t-n}$ is the change in an outcome of interest, such as spending on plant, property and equipment or days of care provided to indigent patients in hospital h, located in county c, between years t and $t-n$. These results are again qualitatively similar to those from our other specifications. Because the long difference minimizes the possible correlation between observed and unobserved hospital characteristics, this third approach is generally our preferred specification.

In addition to spending and service provision, we are also interested in the effect of SB 1953 on the probability of a hospital's closure or license conversion. Because these outcomes are dichotomous, we use probit models to estimate these effects. Since closure is not an uncommon outcome (roughly 13 percent of hospitals in the State closed during our sample period), we also test the sensitivity of these results to simple linear probability models (analogous to the specification above) and obtain similar results.

In all regressions, we control for a basic set of hospital characteristics X_{hct}: bed size, ownership status (for-profit, not-for-profit, or public), license age and its square and rural status, all as of 1992, and multi-system or chain status and its teaching status as of 1996. We also include location (county) fixed effects to control for fixed differences in outcomes that are correlated with broad statewide seismic risk patterns. Thus, the effect of SB 1953 on finances and service provision is identified by differences in seismic risk within an area and across hospital types. The advantage of this approach is that we can account for differences in hospital quality or demand that may exist across areas due to differences in factors such as the socioeconomic characteristics of the population across areas.

2.6 Results

2.6.1 Descriptive Statistics

Table 2-III presents descriptive statistics for all GAC hospitals that filed OSHPD's (required) Annual Financial Reports in sometime between 1996 and 2006.[32] Panel A shows baseline hospital characteristics as of 1992 or 1996, depending on the measure, and Panel B shows some of the outcomes we study. Across both panels, we show descriptive statistics for the full sample and then separately for hospitals that are above and those that are at or below median seismic risk.

As shown in the first column or Panel A, the mean ground acceleration factor is just below 0.5g. Within our sample, seismic risk varies from a minimum of 0.05 and maximum of 1.15 g's and follows a rather bell-shaped distribution. About 28 percent of the hospitals in our sample are investor-owned or for-profit institutions and 19 percent are government-owned. Although investor-owned are slightly more common

[32] Hospitals that do not file the reports on time are fined $100 per day they are late. For details on non-filing penalties, see http://www.oshpd.cahwnet.gov/HID/hospital/finance/manuals/ch7000.pdf

(29.4 versus 27.3 percent) and government-owned slightly less common (17.1 versus 20.0 percent) in above median pga areas, these differences are both small in magnitude and statistically insignificant. About 36 percent of hospitals in the sample are part of a large system or chain. On average, hospital's were 61 years old as of 1992. Both chain status and age are relatively invariant across low and high pga areas.

About 26 percent of the sample are teaching hospitals and 9 percent are in rural areas. The average hospital has 203 licensed beds. These baseline characteristics vary sharply across above and below median pga areas. Whereas 30 percent of hospitals in high pga areas have a teaching program, only 22 percent in low pga areas do. The average hospital has 234 licensed beds in high pga areas and only 177 in low pga areas. These differences can be explained in part by the rural divide. Low pga areas are systematically more rural. Whereas fewer than 1 percent of hospitals in high pga areas areas are rural, over 16 percent in low pga areas are rural. Importantly, our analysis does not rely on an across State, high versus low pga comparison. Rather, our analysis relies on within-county comparisons in seismic risk, which eliminates much of the urban-rural differences. As we will show below (in Table 2-IV), once we control for county, most of these characteristics do not differ systematically with seismic risk. And in all regressions we control for the characteristics listed in Panel A.

Panel B shows means for many of the outcomes we study below. Total spending on plant, property and equipment (PPE) for 2006 was \$136 million, with almost half dedicated to building improvements. Building improvement spending includes architectural, consulting, and legal fees related to the acquisition or construction of buildings as well as interest paid for construction financing. Fixed equipment such as boilers, generators, and elevators are also included in this accounting category.[33] In contrast, spending on construction in progress only accounts for about 6 percent of PPE spending. The difference may reflect the relatively long organizational time horizon for constructing a new facility - four to five years for the in-house planning process alone (Meade and Kulick, 2007). Importantly, the level of PPE spending

[33]See http://www.oshpd.cahwnet.gov/HID/hospital/finance/manuals/ch2000.pdf for details on this and other accounting categories studied here.

(overall and by type) is systematically higher in high pga areas.

Roughly 13 percent or 58 of the hospitals in our sample closed and almost 8 percent, or 33 of them converted ownership status during our sample period. The share of hospitals that closed or converted ownership status are roughly equal across high and low pga hospitals. Those hospitals remaining in the market in 2006 are licensed to have on average 232 beds. And, as in 1996, those in high pga areas are systematically larger, with 272 as compared to 200 licensed beds. Of the licensed beds, 86 percent are staffed – 85 percent in high pga and 87 percent in low pga areas. As expected given the rural divide, high pga areas have systematically more hospitals days and discharges, both overall and by type.

The above versus below median pga comparisons in Table 2-III give us a feel for the type of hospitals that have high versus low seismic risk. Our main analysis, however, is based on a continuous measure of seismic risk and, more importantly, on within county comparisons of this risk. Thus, to give us some confidence in our research design, we next verify that many observable hospital characteristics are uncorrelated with g. We first consider neighborhood characteristics, where neighborhood is defined as all zipcodes within a 5-mile radius of the hospital.[34] We run regressions, based on our main result specifications discussed above, of both the level and change in a hospital's neighborhood characteristics as a function of its seismic risk, it age and its square, the number of licensed beds in 1992 and dummies for 1992 ownership status, an indicator for rural status, based on an OSHPD designation, and county fixed effects.[35] In robustness checks, we also use city fixed effects. We include geographic controls because broad seismic risk patterns across the State correlate closely with broad demographic and socioeconomics differences.[36] Unlike our main results, we generally find no significant correlation between seismic risk and these dependent variables.

[34]We have also defined neighborhood as the hospital's zipcode of operation. Results using this definition are quite similar.

[35]We omit 1996 teaching and system status as controls because they occur after the characteristics studied here.

[36]E.g., San Francisco County is both high seismic risk and high income relative to Sacramento County. As a result, our identification uses only within county variation in seismic risk. Within-city variation would be even cleaner but many small to medium cities have only one hospital.

Panel A of Table 2-IV presents estimates based on the 1990 Census characteristics of a hospital's neighborhood. Within a county, we find no meaningful relationship between pga and the total population in the hospital's neighborhood, the share of the population that is below the federal poverty line, the share Hispanic, the share 5 to 17 years old, and the median household income in the neighborhood. When we look at growth in these characteristics between 1989 and 1999 (in Panel B), we find no significant relationship in 4 out of 5 cases. The exception is for the share living below the federal poverty line. A one standard deviation increase in seismic risk (approximately 0.2g) is associated with almost 6 percentage points higher growth in the share living below the federal poverty line in the neighborhoods surrounding hospitals off a base of 19 percent. Estimates by ownership status reveal that the effects are concentrated in the neighborhoods around public and not-for-profit hospital (available upon request). The effect is indistinguishable from zero in the case of for-profit hospitals. In results not shown here we also fail to find within-county relationships between seismic risk and a range of other observable characteristics - e.g. the share of the population female, the share African-American, the share native-born and the share of households on public assistance - both in 1990 levels and 1990 to 2000 changes. These results are both statistically and economically insignificant.

Panel C of Table 2-IV provides results for hospital characteristics in 1992 and Panel D presents results for 1996 characteristics. The correlation between seismic risk and the probability that a hospital was government-owned or not-for-profit in 1992 is small and imprecise. The relationship between seismic risk and a hospital's age, the probability it had an emergency department, or its average length of stay as of 1992 is also insignificant. And the implied effects are small. For example, a 1 standard deviation increase in seismic risk is associated with about 1.7 fewer license years off a base of 61 years. Moreover, a 1 standard deviation increase in seismic risk implies a 0.7 percentage point lower probability of having an emergency room, off a base of 70 percent, and 4 percent longer average length of stay.

For 4 of the 5 1996 characteristics presented in Panel D - the share of hospitals with a drug detoxification program, the share with a Neonatal Intensive Care Unit

(NICU), the share with MRIs, and the share with blood banks - the correlation with seismic risk is similarly small and imprecise. The one exception is the probability of participating in a county indigent care program. A one standard deviation increase in seismic risk is associated with an 11 percentage point lower probability of participating in the program off a base of about 50 percent. The effects do not differ by ownership status.

On net, in 18 out of 20 cases, seismic risk is uncorrelated with hospitals characteristics, both overall and by ownership status. Since a hospital's ground acceleration factor is broadly unrelated to its observable hospital and neighborhood characteristics but, as we will demonstrate, is directly related to the cost shock imposed by SB 1953, we can use it as a source of randomization of our treatment. In other words, we can identify the impact of SB 1953 by comparing the response of similar hospitals (based on county co-location, rural status, age, ownership type, and so on) BUT for their inherent seismic risk. Because of the considerable small area variation in ground acceleration within county (and even within city), we should have enough power to identify the effect of this cost shock.

2.6.2 Hospital Shutdowns and License Conversions

To the extent that SB 1953 causes a large fixed cost shock and increases the cost of capital, as hospitals compete for scarce financing resources, it may have the unintended consequence of increasing closures. For example, if equity and bond ratings decline for those with higher seismic risk, some hospitals may have difficulty financing their day-to-day activities and may choose to shut down. None of our models generates different predictions for the probability of closure. However, this outcome is interesting in its own right. Moreover, if we find differential probabilities of closure by ownership type, we will face a sample selection problem in our assessments of the effect of seismic risk on other outcomes.

Table 2-V presents both probit and linear probability models of the likelihood that a hospital shuts down after 1996. Both models imply a significant impact of seismic risk on the probability of closure: a one standard deviation increase in the ground

acceleration factor increases the likelihood of closure by 6 to 7 percentage points. Importantly for our research design, we cannot reject that the impact of seismic risk on the probability of closure is similar across ownership types. To corroborate the role of the mandate in causing closures, we run a placebo test of the relationship between seismic risk and pre-1997 hospital closures. These results, presented in Appendix Table 2-V, indicate that the correlation between seismic risk and closure is negative, small in magnitude and indistinguishable from zero prior to 1997.[37]

Together with the placebo result, we conclude that the mandate itself is causing closures and is not simply exacerbating pre-existing trends in hospital closures, which were concentrated in for-profit facilities (see Buchmueller et al., 2006). Morever, these results indicate that SB1953 has put financial pressure on all hospitals with high seismic risk. The government is not, for example, shielding its hospitals from this pressure. While Duggan (2000) finds that localities reduce their allocations to public hospitals receiving "extra" State funds for treating a "disproportionate share" of publicly insured patients, our results suggest that the fixed cost shock studied here is large enough to strain the government's ability to soften the budget constraint enough to fully shield their hospitals from financial pressure. Most importantly for our analytic purposes, these results provide some evidence that SB1953 has bite. Hospitals are not simply ignoring the legislation in the hopes that the State will "bail" them out.[38]

Table 2-V also explores the relationship between seismic risk and the probability that a hospital converts its license (e.g. from not-for-profit to for-profit status, the most common type of conversion). We might expect not-for-profit (and possibly public) hospitals with higher fixed cost shocks to convert their licenses if this eases credit constraints. Our point estimates suggest that seismic risk actually lowers the

[37]Given the relatively low rate of closure over this period - just under 4 percent - the Probit model may be more appropriate. However, because closures were concentrated in a few counties and closures by ownership status varied very little within-counties over this period, we are unable to estimate Probit models with interaction effects. Based on the OLS model, however, we find no evidence of seismic risk effects, irrespective of ownership status.

[38]We should also note that these results are not driven by Los Angeles County, where several hospitals were damaged by the Northridge Earthquake. Estimates that exclude hospitals in Los Angeles County are virtually identical (available upon request).

likelihood that a not-for-profit converts to for-profit status and, based on the OLS regression, that a public converts to for-profit or not-for-profit status. A one-standard deviation increase in seismic risk lowers the probability of license conversion by about 6 percentage points. We take these results as some indication that private financial markets are less willing to lend to high seismic risk hospitals. High seismic risk hospitals should be less likely to convert their licenses if doing so is unlikely to ease credit constaints. As a result, this finding suggests that any increases in the provision of profitable services may well be lowerbounds relative to what a high-seismic risk not-for-profit hospital would like to produce. Taken together with the results on closures, the license conversion results indicate that the seismic retrofit mandate had real implications for California's hospitals and was not simply another set of requirements to be ignored.

2.6.3 Seismic Risk and Spending

We next, in Table 2-VI, assess the extent to which seismic risk predicts differences in aggregate building-related expenditures. Because hospitals have some flexibility in how and when they account for different expenditures, we consider any spending on plant, property and equipment (PPE) for all years between 1996 and 2006. Panel A shows results for the set of hospitals existing in 1996 and 2006. Results in cols (1) and (2) are based on total spending levels; cols (3) and (4) are based on the log of total spending.

As shown in cols (1) and (3), a hospital's ground acceleration factor is positively related to total PPE spending over the sample period. A one-standard deviation increase in the ground acceleration factor is associated with roughly $200 million in spending on plant, property and equipment between 1996 and 2006. The estimate in levels (col (1)) is only statistically significant at the 10 percent level. When we allow for differential effects of seismic risk by ownership type, the effects on spending become clearer. The main effects, which isolate the impact of seismic risk on spending by not-for-profit hospitals, imply slightly larger seismic risk effects than in the simple model: a one standard deviation increase in pga is associated with higher PPE spending of about \$320 million between 1996 and 2006. Across both specifications, the interactions between pga and for-profit or public ownership status are negative. Based on the magnitudes and precision of these estimates, we cannot reject zero effect of seismic risk on PPE spending by for-profit and public hospitals. The results are qualitatively similar when spending is expressed in logs.

In panel B, we test the sensitivity of these estimates to the inclusion of hospitals that close or do not report because of mergers or other unobserved reasons.[39] Specifically, we set to zero any missing PPE spending values between 1996 and 2006. As expected the estimates in Panel B are slightly smaller. But, the magnitudes and pattern of results are quite similar to those in Panel A. Not-for-profit hospitals with higher seismic risk spend hundreds of millions of dollars more on PPE over the 1996-2006 period than their for-profit or public counterparts.

These findings may capture the fact that not-for-profit hospitals tend to be larger and have more SPC 1 buildings than their for-profit counterparts (an average of almost 2.7 compared to about 1.5 for public and for-profits combined). Not-for-profit hospitals may be farther along in their retrofitting timelines than either public or for-profit hospitals or they may have responded more quickly to the mandate.[40] Because we cannot rule out that for-profit and public hospitals have readjusted their budgets in other ways (e.g. inter-temporally) and given our finding that seismic risk increases closures irrespective of ownership type, we do not interpret this as evidence that the cost shock is only binding for not-for-profit hospitals. Rather we take it as the first piece of evidence that not-for-profits respond differently to this mandate than for-profit hospitals.

[39] After a merger, hospitals have the option to retain separate reporting systems or to report as one institution.

[40] As evidence of the latter, we find that, controlling for the same covariates as in our main regressions, not-for-profit hospitals request extensions on average a half year earlier than for-profit hospitals and almost a a full year earlier than public hospitals. However, seismic risk does not predict extension requests or approval. This is not too surprising given that over 80 percent of hospitals requested an extension and 98 percent received them.

2.6.4 Services

In order to better test our models of hospital behavior, we next consider the impact of seismic risk on service provision. Because the mandate does not alter the "price" of hospital services, seismic risk and the requirements of the seismic retrofit mandate should only affect service provision to the extent that hospitals are not already profit-maximizing. Hospitals that are not simply profit-maximizing will have to reoptimize. Altruistic firms will be forced to cut back on (unprofitable) above-market quality and quantity of services. Perquisite-maximizers will be forced to increase the provision of profitable services and reduce their consumption of perquisites.

To test these theories, we first consider the overall volume of service. Table 2-VII shows the impact of seismic risk on *changes* in patient days and discharges between 1997 and 2005. As shown in the first column, hospitals with higher seismic risk increased their patient-days over the 1997-2005 period. A one-standard deviation increase in seismic risk is associated with almost 2400 more patient-days. The next column breaks out the effect by ownership type. Patient-days clearly increase for not-for-profit hospitals with higher seismic risk. A one-standard deviation increase in seismic risk among not-for-profit hospitals is associated with about 2900 more patient-days. We cannot reject zero effect of seismic risk on overall patient days for government-owned and for-profit hospitals. That only not-for-profit hospitals with higher seismic risk increase patient days suggests that they were not profit-maximizing to begin with; the increase in volume is most consistent with perquisite maximization.

As shown in col (3), seismic risk is also associated with an increase in discharges, though the estimate is too imprecise to rule out zero effect. Breaking the estimates out by ownership type provides little additional information. One interpretation of these results is that high seismic risk not-for-profit hospitals increase length of stay rather than volume per se. In other words, if not-for-profits are increasing patient days but not discharges, then they must be increasing length of stay for those patients that are admitted. But, the large standard errors suggest some caution in making this case too strongly.

Table 2-VIII tries to determine if the increase in patient days for not-for-profits with higher seismic risk comes through hospital expansion or more intensive use of existing services. Seismic risk is associated with slightly more licensed beds in 2006. Excluding interactions, we find that a one standard deviation increase in pga is associated with about 15 more licensed beds. When we break the result out by ownership, however, we find that this result is only distinguishable from zero for government-owned hospitals. The next two columns (col (3) and (4)) consider the share of licensed beds that are actually staffed and thus available for patient use. Here we find that, higher seismic risk is associated with a higher share of staffed beds. A one-standard deviation increase in seismic risk is associated with a roughly 4 percentage point higher share of staffed beds. The results by ownership type in col (4) reveal that only not-for-profit and public hospitals with higher seismic risk increase the share of staffed beds. Together with the results from cols (1) and (2), these findings imply that while government-owned hospitals increase both the number of beds for which they are licensed and the share that are staffed and available for patient use, not-for-profits respond primarily be increasing the staffing of existing beds. In other words, not-for-profits facing higher fixed cost shocks choose to use the physical resources at their disposal more intensively. In Tables 2-IX-XI we next consider changes in the volume of specific services. In Table 2-IX we look at changes in indigent care. We focus on un-reimbursed care not care that can be reimbursed by county indigent programs. We look at changes in total inpatient indigent care days as well as inpatient GAC days. We also look separately at changes in indigent care visits to a hospital's emergency department and to a clinic. When pooling across ownership type, we find small and extremely imprecise negative relationships between pga and indigent care days or visits (not shown here). When we break the effects out by ownership type, however, we find that only government-owned hospitals unambiguously respond to seismic risk by changing their provision of charity care. Specifically, a one-standard deviation increase in seismic risk is associated with 330 fewer days of indigent care.[41] This estimate is distinguishable from zero at the 10

[41]We arrive at this figure by multipluing the sum of the main effect of 475 and the differential

percent level. This effect appears to be driven by GAC days: a one-standard deviation increase in seismic risk is associated with 194 fewer indigent GAC days in public hospitals. The estimate for indigent ER visits also suggests a decline for high seismic risk public hospitals but is too imprecise to distinguish from zero. In contrast, public hospitals with higher seismic risk clearly cut free/reduced price clinic visits. A one-standard deviation increase in seismic risk is associated with about 745 fewer of these visits. How these hospitals reduce these visits is unclear in our data. They may, for example, close their doors on certain days of the week, limit the number of patients they see or do both.

These results - that public hospitals facing larger fixed cost shocks cut back on subsidized care - suggest that SB1953 has put pressure on the soft budget constraint of government-owned hospitals. That not-for-profit hospitals facing larger fixed cost shocks do not cut back on charitable is inconsistent with the predictions of the altruistic model. To help us further distinguish between the altruistic and perquisite-maximizing models of not-for-profit behavior, we next consider the provision of profitable services. Whereas welfare-maximizing firms, which overprovide quantity and quality, are predicted to cut back on profitable services, perquisite-maximizing firms should increase provision. We draw heavily on Horwitz (2005) to classify services as relatively profitable or generously reimbursed.

Table 2-X looks at neonatal care in terms of the probability of adding a neonatal intensive care unit (NICU) as well as NICU beds, patient days and discharges. The first two columns of Table 2-X assess the probability that hospitals add a NICU between 1992 and 2006. If anything, we find that not-for-profit and public hospitals with higher seismic risk are less likely to add NICUs. Thus, we take these regressions as evidence that, at a minimum, not-for-profit hospitals with higher seismic risk are not adding NICUs, although the point estimates vary markedly across models. The sign of the effect is not too surprising, however, given that higher seismic risk implies a larger financial hit from the mandate, which might make it more difficult to finance the high-tech equipment and hire the specialized staff required to run a NICU.

public hospital effect of -1871 by the 0.2, a standard deviation change in seismic risk.

Although not-for-profits with higher seismic risk are not adding NICUs, those with NICUs are using them more intensively. While the results for beds and discharges are indistinguishable from zero, we find that a one-standard deviation increase in seismic risk is associated with 464 more NICU patient days at not-for-profit hospitals. Importantly, this increase is specific to not-for-profits; the estimates for for-profit and public hospitals are both small in magnitude and indistinguishable from zero. Moreover, together with the results for discharges, this implies that the primary way not-for-profits are increasing neonatal intensive care is through longer lengths of stay.

In table XI, we next consider an unrelated type of profitable service - the use of Magnetic Resonance Imaging (MRI). We measure use as minutes provided and consider total minutes as well as inpatient and outpatient minutes separately. It is the latter type of care that should be the most profitable as it will not be reimbursed as part of a general visit. Like neonatal and obstetrics care, MRI minutes increase for not-for-profit hospitals facing higher seismic risk. A one standard deviation increase in seismic risk is associated with about 2100 more minutes or about 35 more hours of outpatient MRI use. In contrast, we find no significant effects of seismic risk on MRI minutes for either for-profit or public hospitals. Taken together, the results from Tables 2-X-XI, rule out purely altruistic models and lend strong support to perquisite-maximizing models of private not-for-profit hospital behavior.

2.7 Conclusions

Both policymakers and academics have long struggled to understand what not-for-profit hospitals do. While theories of not-for-profit hospital behavior abound, they typically lay out general motivations without specifying any formal structure. As a result, distinguishing across these theories has proven challenging. In this paper, we overcome this difficulty by embedding in a very general framework three of the leading theories of not-for-profit hospital behavior: 1) "for-profits in disguise," (2) welfare maximizers, and (3) perquisite maximizers. We derive the response of not-for-profit hospitals to a large fixed cost shock under each of these hypotheses. While for-profits in disguise may shut down in response to a large fixed cost shock, their service provision should remain otherwise unaffected. In contrast, welfare maximizers, who "overprovide" quantity and quality relative to pure profit-maximzers, will be forced to cut back on this work. In sharp contrast, perquisite-maximizers should respond by increasing the provision of profitable care and cutting back on perquisites.

We test these predictions by studying the effect of an unfunded mandate requiring all GAC hospitals in California to retrofit or rebuild in order to comply with modern seismic safety standards. We show that hospitals with higher seismic risk are more likely to shut down, irrespective of ownership type, and that not-for-profits with high seismic risk experience larger increases in spending on plant, property and equipment. Not-for-profits alone also increase their mix of profitable services - e.g. neonatal intensive care days, obstetrics discharges and MRI minutes. Government hospitals respond by decreasing the provision of charity care. As expected, for-profit hospitals do not change their service mix in response to this shock.

In the case of not-for-profit hospitals, these results are consistent with the idea of perquiste maximization and allow us to reject two of the leading theories of not-for-profit hospital behavior - "for-profits in disguise" and "pure altruism." The tax subsidies provided to not-for-profit hospitals allow them to pursue higher "quality" of services at the expense of quantity. The welfare implications of these results are, however, theoretically ambiguous. More work is needed to determine whether the welfare gains from the increases in quality (including possible technological spillovers) offset the loss in welfare caused by reduced quantity. Such work is crucial for the policy debate, which has largely ignored this class of models and focused on the simpler and more extreme cases of 'for-profits in disguise" and "pure altruism."

In contrast the behavior of government-owned hospitals is most consistent with welfare as firm maximand. As discussed in Hart, Shleifer and Vishny (1997), this does not necessarily imply that health care should be provided by the government since the same incentive structure that leads government owned hospitals to maximize welfare may correspond to a too-low incentive for efficient production. A separate analysis of the relationship between firm ownership structure and costs is necessary to determine whether government provision of health services is socially efficient.

2.A Appendix: Figures and Tables

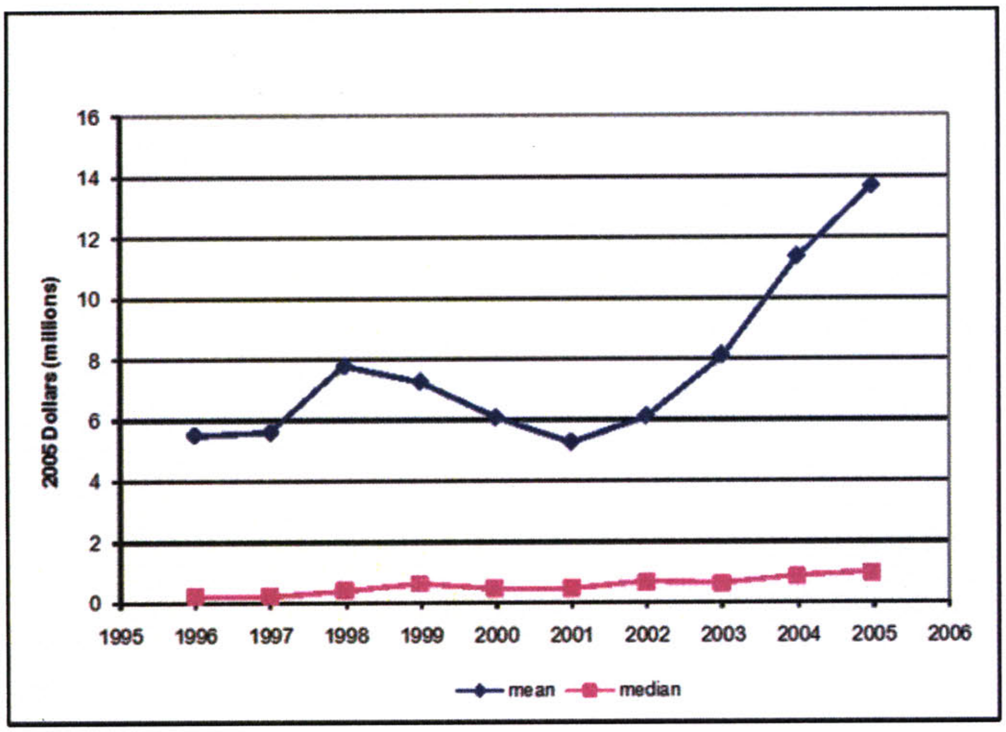


Figure 2-1. Trends in the Mean and Median Value of Construction in Progress by California Hospitals: Fiscal Years 1996-2005.

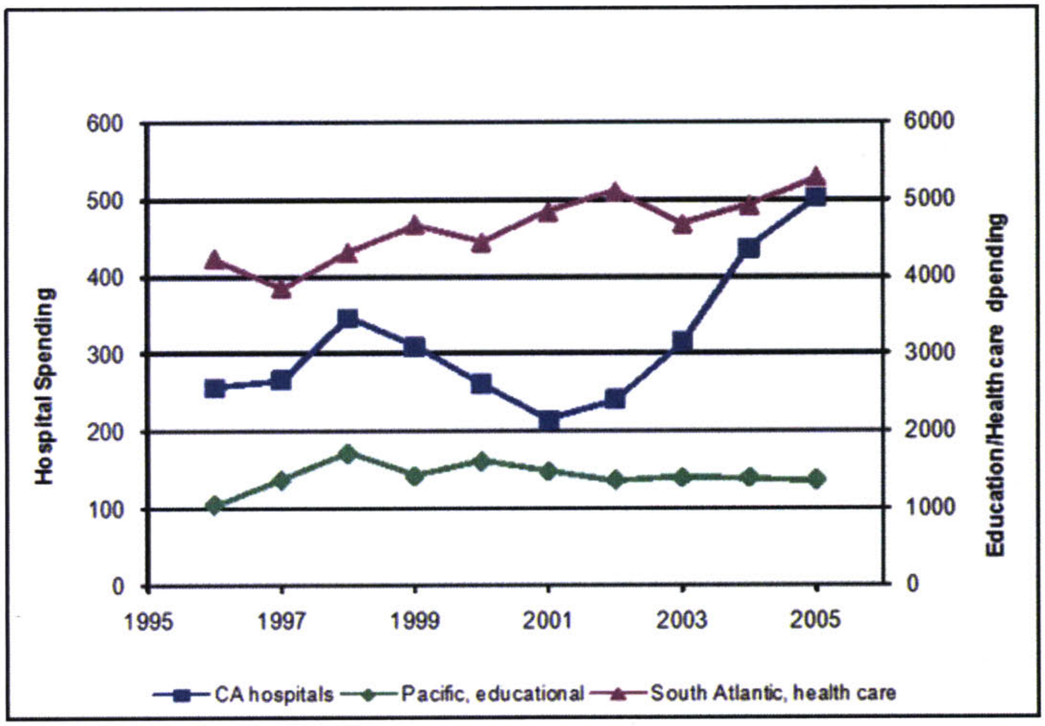


Figure 2-2. Total Value of Construction Spending by Location and Type in Millions of 2005 Dollars: Fiscal Years 1996-2005.

Table 2-I
Basic Information for SB 1953 [a]

Panel A	*Key Provisions of SB 1953*
Date	*Requirement*
Jan 2001	Submit risk assessment with NPC and SPC ratings for all buildings and a compliance report.
Jan 2002	Retrofit nonstructural elements (e.g. power generators) and submit a plan for complying with structural safety requirements.
Jan 2008	Collapse hazard buildings should be retrofitted or closed. Extensions available through 2013.
Jan 2030	Retrofit to remain operational following a major seismic event.

Panel B	*Structural Performance Categories (SPC)*
Rating	*Description*
SPC 1	Pose significant risk of collapse and a danger to the public. Must be brought to level SPC2 by Jan. 1. 2008. 5-year extensions to 2013 may be granted.
SPC 2	Buildings do not significantly jeopardize life but may not be repairable or functional following a strong earthquake. Must be brought into compliance with SB1953 by Jan. 1 2030 or be removed from acute care services.
SPC 3	May experience structural damage that does not significantly jeopardize life, but may not be repairable following an earthquake. Has been constructed or reconstructed under an OSHPD building permit. May be used to Jan 1. 2030 and beyond.
SPC 4	In compliance with structural provisions of SB1953, but may experience structural damage inhibiting provision of services following a strong earthquake. May be used to Jan. 1. 2030 and beyond.
SPC 5	In compliance with structural provisions of SB1953 and reasonably capable of providing service after a strong earthquake. May be used to Jan. 1. 2030 and beyond.

Panel C	*Non-Structural Performance Categories (NPC)*
Rating	*Description*
NPC 1	Equipment and systems to not meet any bracing requirements of SB1953.
NPC 2	By Jan. 1, 2002, communications, emergency systems, medical gases, fire alarm, emergency lighting systems in exit corridors must be braced to Part 2, Title 24 requirements
NPC 3	Meets NPC2. By Jan. 1, 2008, non-structural components in critical care, clinical labs, pharmacy, radiology central and sterile supplies must be braced to Part 2, Title 24. Fire sprinkler systems must be braced to NFPA 13, 1994, or subsequent applicable standards. May be used until Jan. 1., 2030.
NPC 4	Meets NPC 3. Architectural, mechanical, electrical systems, components and hospital equipment must be braced to Part 2, Title 24 requirements. May be used until Jan. 1., 2030.
NPC 5	Meets NPC 4. By Jan 1., 2030, must have on-site supplies of water, holding tanks for wastewater, fuel supply for 72 hours of emergency operations. May be used until Jan. 1, 2030 and beyond.

[a]Notes:

1. SPC stands for "Structural Performance Category"; NPC stands for "Non-structural Performance Category."
2. Sources: http://www.oshpd.ca.gov/fdd/sb1953/sb1953rating.pdf
3. See http://www.oshpd.ca.gov/fdd/sb1953/FinalJan2008Bul.PDF for extension information.

Table 2-II

Summary of Predictions [a]

	Profitable Care (q)	*Uncompensated Care (u)*	*Quality (Q)*
FPID	**0**	**0**	**0**
Altruistic	-	-	-
Prestige	+	**0**	-

[a]Notes:

1. This table describes the response to a fixed cost shock predicted by each of these models.
2. 0 indicates no change, - indicates a decrease, and + indicates an increase in this type of service.

Table 2-III
Descriptive Statistics [a]

Panel A		*Baseline Hospital Characteristics*	
	Full Sample	*Above median pga*	*At or below median pga*
seismic risk, pga	0.480	0.660	0.326
	(0.207)	(0.130)	(0.118)
investor-owned	0.282	0.294	0.273
government-owned	0.186	0.171	0.200
belongs to a system	0.364	0.370	0.359
rural	0.090	0.005	0.163
teaching hospital	0.261	0.309	0.221
licensed beds	203	234	177
	(188)	(223)	(147)
license age	61.3	60.4	62.0
	(13.7)	(14.2)	(13.2)

Panel B		*Hospital Outcomes*	
	Full Sample	*Above median pga*	*At or below median pga*
PPE spending	110	136	89.4
	(148)	(173)	(114)
closed	0.134	0.133	0.134
converted ownership status	0.075	0.081	0.069
Licensed beds	232	272	200
	(190)	(219)	(155)
Share beds staffed	0.860	0.853	0.867
Hospital days	50425	58698	43299
	(44892)	(53098)	(35258)
Discharges	10019	11362	8900
	(8543)	(9053)	(7944)
Indigent Care days	442	472	418
	(985)	(961)	(1007)
NICU days	1992	2612	1407
	(3712)	(4291)	(3116)
Observations	456	211	245

[a]Notes:

1. Observations are for all hospitals reporting to OSHPD during our sample. Sample sizes for any given item or year may vary. Standard deviations are given in parenthesis.
2. pga measures the maximum ground acceleration that is expected to occur with a 10 percent probability in the next 50 years.
3. Ownership status, beds and license age are as of 1992; system and teaching status are as of 1996. License age is (1992 - year of the hospital's OSHPD license). A teaching hospital is one with an approved residency program.
4. Licensed beds are the maximum number of beds for which a hospital holds a license to operate; available beds are the number they physically have and staffed beds are the the number for which staff is on hand. See http://www.ahrq.gov/research/havbed/definitions.htm
5. In Panel B, all outcomes are for 2006 except for the closure and for-profit conversion outcomes, which measure events occurring between 1997 and 2006. Dollar values are in 2005 terms and are given in millions.

Table 2-IV
Seismic Risk and Hospital Observables [a]

Panel A	*Neighborhood Characteristics: 1989*				
	Log Pop	*Share Below FPL*	*Share Hispanic*	*Share 5-17 Yr Olds*	*Log(Median Income)*
pga	.448	-.007	.0371	-0.016	0.099
	(.668)	(0.034)	(0.092)	(0.018)	(0.153)
R-squared	0.738	0.345	0.435	0.360	0.410
Mean of Dep. Var.	12.1	0.150	0.313	.196	10.7
Observations	370	370	370	370	370

Panel B	*Growth in Neighborhood Characteristics: 1989-1999*				
	Pop	*Share Below FPL*	*Share Hispanic*	*Share 5-17 Yr Olds*	*Median Income*
pga	0.063	0.297	0.142	0.101	-.033
	(0.082)	(0.145)	(0.099)	(0.071)	(0.064)
R-squared	.284	0.427	0.348	0.275	0.503
Mean of Dep. Var.	0.104	0.183	0.346	0.082	0.325
Observations	370	368	368	369	369

[a]Notes:

1. Dependent variables in Panel A and B are based on zip codes within 5-miles of a hospital. Panel A data are from the 2000 census. Panel B data are based on changes between the 1990 and 2000 census values.
2. Dependent variables in Panel C are from OSHPD's Hospital Annual Utilization Reports.
3. All models include county fixed effects as well as a dummy for rural status. Except where used as a dependent variable for the purposes of this randomization check, models also control for a hospital's license age and its square, the number of licensed beds in 1992 and dummies for 1992 ownership status. Models of 1990 demographics or demographic changes between 1990 and 2000 also control for 1996 teaching status and 1996 multi-hospital system status. In all models, standard errors are clustered at the city level to allow for spatial correlation in seismic risk.

Seismic Risk and Hospital Observables (Cont.) [a]

Panel C	*Hospital Characteristics: 1992*				
	Share Public	*Share NFP*	*License Age*	*Share with ER*	*Log (Avg. GAC LOS)*
pga	0.017	0.007	-8.61	-.034	.200
	(0.233)	(0.268)	(7.25)	(.177)	(.202)
R-squared	0.352	0.108	0.100	0.268	.089
Mean of Dep. Var.	0.213	0.500	61.0	.703	1.61
Observations	370	370	370	370	364

Panel D	*Hospital Characteristics: 1996*				
	Share with Detox Program	*Share with NICU*	*Share with MRI*	*Share with Blood Bank*	*Participating in Indigent Programs*
pga	0.175	-0.015	-0.045	-.141	-0.536
	(0.172)	(0.201)	(0.227)	(.276)	(0.240)
R-squared	0.042	0.149	0.092	.117	0.314
Mean of Dep. Var.	0.155	0.145	0.456	0.675	0.508
Observations	370	370	370	370	370

[a]Notes:

1. Dependent variables in Panel D are from OSHPD's Hospital Annual Financial Data.
2. All models include county fixed effects as well as a dummy for rural status. Except where used as a dependent variable for the purposes of this randomization check, models also control for a hospital's license age and its square, the number of licensed beds in 1992 and dummies for 1992 ownership status. Models of 2000 demographics or demographic changes between 1990 and 2000 also control for 1996 teaching status and 1996 multi-hospital system status. In all models, standard errors are clustered at the city level to allow for spatial correlation in seismic risk.

Table 2-V
Hospital Closures and Conversions: 1997-2006 [a]

	Probability of Hospital Closure				*Probability of Ownership Conversion*			
	Probit (Marginal Effects) (Prob.=0.163)		*OLS (Prob.=0.134)*		*Probit (Marginal Effects) (Prob.=0.111)*		*OLS (Prob.=0.075)*	
pga	0.287	0.331	0.338	0.326	-0.311	-0.310	-0.323	-0.307
	(0.137)	(0.162)	(0.139)	(0.140)	(0.142)	(0.153)	(0.148)	(0.148)
pga * For-Profit		-0.093		-0.046		-0.038		0.006
		(0.199)		(0.268)		(0.252)		(0.202)
pga * Public		0.053		0.090		0.021		-0.065
		(0.210)		(0.209)		(0.174)		(0.141)
For-Profit	0.060	0.071	0.118	0.141	-0.041	-0.024	-0.037	0.018
	(0.051)	(0.053)	(0.053)	(0.150)	(0.036)	(0.127(	(0.041)	(0.080)
Public	-0.027	-0.013	0.001	-0.044	0.015	0.003	0.015	0.012
	(0.037)	(0.048)	(0.044)	(0.132)	(0.041)	(0.098)	(0.047)	(0.102)
Multi-Site	-0.007	-0.006	-0.002	- 0.004	-0.097	-0.098	-0.088	0.079
	(0.029)	(0.029)	(0.042)	(0.041)	(0.029)	(0.029)	(0.030)	(0.031)
Rural	0.213	0.210	0.202	0.210	-0.004	-0.001	0.006	0.013
	(0.158)	(0.101)	(0.098)	(0.101)	(0.077)	(0.081)	(0.087)	(0.087)
Teaching	0.021	0.021	0.005	0.005	-0.004	-0.004	0.003	0.003
	(0.038)	(0.038)	(0.040)	(0.041)	(0.033)	(0.033)	(0.038)	(0.038)
Licensed Beds	-0.050	-0.051	-0.034	-0.035	-0.001	-0.001	0.001	0.001
(per 100)	(0.010)	(0.010)	(0.010)	(0.010)	(0.001)	(0.001)	(0.006)	(0.001)
Age * 10	0.085	0.085	0.094	0.095	0.002	0.003	0.003	0.001
	(0.040)	(0.041)	(0.035)	(0.035)	(0.052)	(0.050)	(0.030)	(0.030)
Age Squared * 10	-0.001	-.001	-0.001	-0.001	0.0001	0.0001	0.0001	0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.004)	(0.004)	(0.002)	(0.0003)
Adj. R-squared	-	-	0.048	0.043	-	-	0.025	0.011
Observations	320	320	429	429	298	298	429	429

[a]Notes:

1. All regressions include county fixed effects as well as the number of licensed beds in 1992, the hospital's license age in 1992 and its square, 1992 ownership status (government-owned or for-profit, with not-for-profit status excluded), rural status, 1996 teaching status and 1996 multi-hospital system status. Teaching status and system status are measured as of 1996 because of data limitations. Standard errors are clustered at the city level.

Table 2-VI
Plant Property and Equipment Spending [a]

Effect of g on PPE Spending 1996-2006 (in millions)

Panel A	*Hospitals in Continuous Operation, 1996-2006*			
	TOTAL		*Log(TOTAL)*	
pga	1030	1620	1.37	1.80
	(599)	(710)	(0.571)	(0.571)
pga * For-Profit		-2130		0.159
		(764)		(1.11)
pga * Public		-1460		-2.07
		(726)		(0.645)
For-Profit	-522	179	-1.25	-1.36
	(138)	(372)	(0.193)	(0.580)
Public	-819	273	-0.575	0.488
	(245)	(340)	(0.155)	(0.357)
Adj. R-squared	0.447	0.460	0.587	0.599
Observations	313	313	313	313

Panel B	*All Hospitals in Operation in 1996*			
	TOTAL		*Log(TOTAL)*	
pga	889	1220	-.500	.938
	(526)	(627)	(.593)	(0.584)
pga * For-Profit		-774		-0.210
		(429)		(0.955)
pga * Public		-787		-1.86
		(293)		(0.697)
For-Profit	-302	160	-1.50	-1.42
	(108)	(211)	(0.169)	(0.488)
Public	-588	-178	-.674	0.252
	(197)	(114)	(0.166)	(0.398)
Adj. R-squared	0.375	0.376	0.527	0.534
Observations	428	428	405	405

[a]Notes:

1. All regressions include the number of licensed beds in 1992 and dummies for 1992 ownership status (government-owned or for-profit with not-for-profit status excluded), license age as of 1992 and its square, rural status, 1996 teaching status, 1996 multi-hospital system status and county location. Standard errors are clustered at the city level.
2. Amounts for all years deflated to 2005 dollars.
3. PPE includes land purchases, building improvements, equipment spending and construction costs.
4. Panel A includes only hospitals continuously in operation between 1996 and 2006; Panel B sets missing PPE values to zero.

Table 2-VII
Changes in Total Care : 1997-2005 [a]

	Change in Hospitals Days		*Change in Hospitals Discharges*	
pga	12,003	14,537	1,768	2,013
	(6963)	(6,632)	(1,464)	(1,402)
pga * For-Profit		-11,184		885
		(12,966)		(1,737)
pga * Public		-7,295		-1,615
		(11,321)		(2,428)
For-Profit	-4,126	1,438	-1,117	-1,576
	(2,071)	(6,882)	(394)	(1,009)
Public	-9,811	-6,052	-1135	-297
	(3,318)	(6,639)	(645)	(1,502)
Multi-Site	-1,093	-228	-126	-107
	(1,760)	(1,797)	(375)	(376)
Rural	-8,992	-,9070	-1,475	-1,724
	(3,355)	(3,643)	(792)	(838)
Teaching	5,715	6,111	393	368
	(1977)	(2,145)	(338)	(346)
Licensed Beds	-1,610	-1,611	-238	-232
(per 100)	(653)	(653)	(164)	(168)
Age	-90.1	-79.5	8.01	4.59
	(362)	(386)	(46.0)	(45.4)
Age Squared	0.313	0.189	-0.030	-.003
	(2.83)	(3.03)	(0.414)	(0.411)
Adj. R-squared	0.016	0.011	0.038	0.043
Observations	356	356	356	356

[a]Notes:

1. Patient days and discharges are from OSHPD's Inpatient Hospital Discharge Data files.
2. All regressions include the number of licensed beds in 1992 and dummies for 1992 ownership status (government-owned or for-profit with not-for-profit status excluded), license age as of 1992 and its square, rural status, 1996 teaching status, 1996 multi-hospital system status and county location. Standard errors are clustered at the city level.

Table 2-VIII
Licensed and Staffed Beds in 2006 [a]

	Licensed Beds		*Share Staffed*	
pga	74.7	57.8	0.222	0.220
	(52.2)	(61.8)	(0.095)	(0.104)
pga * For-Profit		-6.11		-0.262
		(80.8)		(0.186)
pga * Public		87.6		0.122
		(66.6)		(0.118)
For-Profit	-10.7	-7.24	-0.052	0.078
	(10.7)	(40.1)	(0.031)	(0.091)
Public	-23.9	-69.2	- 0.006	-0.069
	(12.9)	(33.3)	(0.034)	(0.071)
Multi-Site	-29.6	-18.1	-0.006	-0.005
	(15.9)	(13.9)	(0.028)	(0.027)
Rural	-61.6	-45.8	0.019	0.053
	(23.7)	(24.3)	(0.053)	(0.053)
Teaching	30.9	31.8	-0.061	-0.059
	(11.9)	(11.8)	(0.027)	(0.027)
Licensed Beds	77.5	77.2	-0.016	-0.017
(per 100)	(6.47)	(6.30)	(0.005)	(0.005)
Age	1.34	1.41	-0.003	-0.003
	(1.01)	(1.04)	(0.004)	(0.003)
Age Squared	-0.012	-0.012	0.00002	0.00002
	(0.008)	(0.008)	(0.00003)	(0.00002)
Adj. R-squared	347	347	347	347
Observations	0.81	0.81	0.098	0.103

[a]Notes:

1. All regressions include the number of licensed beds in 1992 and dummies for 1992 ownership status (government-owned or for-profit with not-for-profit status excluded), license age as of 1992 and its square, rural status, 1996 teaching status, 1996 multi-hospital system status and county location. Standard errors are clustered at the city level.

2. Licensed beds are the total number of beds a hospital is licensed to have. Staffed beds are the number of beds in the hospital for which a hospital has assigned staff personnel.

Table 2-IX
Changes in Uncompensated Care: 2002-2006 [a]

	Total Indigent Days	*Indigent GAC Days*	*Indigent ER Visits*	*Clinic Visits*
pga	475	267	376	334
	(356)	(333)	(534)	(621)
pga * For-Profit	247	149	198	-1,140
	(474)	(407)	(659)	(947)
pga * Public	-1,871	-1,235	-2,438	-4,059
	(751)	(536)	(1,226)	(2,066)
For-Profit	-108	-101	15.4	-381
	(244)	(213)	(336)	(452)
Public	839	523	1,139	2,001
	(416)	(305)	(746)	(986)
Multi-Site	84	66	-48	502
	(105)	(91)	(180)	(353)
Rural	-138	-95	-485	-378
	(149)	(115)	(272)	(322)
Teaching	-22	23	47.0	110
	(126)	(103)	(202)	(322)
Licensed Beds	35	28	16	35
(per 100)	(26)	(21)	(33)	(67)
Age	4.47	4.56	11.5	-16.4
	(7.44)	(5.69)	(9.5)	(23.3)
Age Squared	-0.032	-0.035	-0.142	0.055
	(0.072)	(0.051)	(0.078)	(0.174)
Adj. R-squared	0.011	0.017	0.087	0.073
Observations	340	340	340	340

[a]Notes:

1. All regressions include the number of licensed beds in 1992 and dummies for 1992 ownership status (government-owned or for-profit with not-for-profit status excluded), license age as of 1992 and its square, rural status, 1996 teaching status, 1996 multi-hospital system status and county location. Standard errors are clustered at the city level.

2. The dependent variables represent the difference in average 2002 to 2003 and 2005 to 2006 indigent care days by type.

Table 2-X
Neonatal Intensive Care Units (NICU) [a]

	Prob. Adding NICU 1992-2006		*Change 1992-2006*		
	Probit (Marginal Effects) *(P = 0.117)*	*OLS* *(P = 0.091)*	*NICU Beds*	*Discharges*	*Days*
pga	-0.068	-0.211	5.74	41.1	2320
	(0.037)	(0.129)	(5.13)	(73.8)	(1271)
pga * For-Profit	0.022	0.032	-6.22	-169	-1508
	(0.038)	(0.150)	(4.40)	(112)	(1115)
pga * Public	-0.136	-0.212	-6.86	-176	-1073
	(0.075)	(0.159)	(5.25)	(202)	(1716)
For-Profit	-0.049	-0.124	0.072	18.6	141
	(0.033)	(0.083)	(2.29)	(15.6)	(573)
Public	0.483	-0.071	3.19	79.4	-314
	(0.397)	(0.098)	(2.19)	(119)	(1084)
Multi-Site	0.009	0.026	-0.905	41.7	-186
	(0.010)	(0.028)	(1.07)	(57.6)	(238)
Rural		-0.134	-3.11	-98.5	-251
		(0.058)	(1.07)	(39.4)	(378)
Teaching	-0.018	-0.078	0.286	70	-80
	(0.008)	(0.027)	(1.15)	(43)	(309)
Licensed Beds	0.001	0.001	-0.160	-24.0	-162
(per 100)	(0.001)	(0.004)	(0.680)	(12.7)	(107)
Age	0.001	0.001	0.037	-.940	21.7
	(0.002)	(0.002)	(0.077)	(3.09)	(18.4)
Age Squared	-0.00002	-0.00001	-0.0007	-0.019	-0.316
	(0.00001)	(0.00002)	(0.0006)	(0.024)	((0.168)
R-squared	–	0.113	0.07	0.08	0.03
Observations	292	429	364	372	372

[a]Notes:

1. All regressions include the number of licensed beds in 1992 and dummies for 1992 ownership status (government-owned or for-profit with not-for-profit status excluded), license age as of 1992 and its square, rural status, 1996 teaching status, 1996 multi-hospital system status and county location. Standard errors are clustered at the city level.

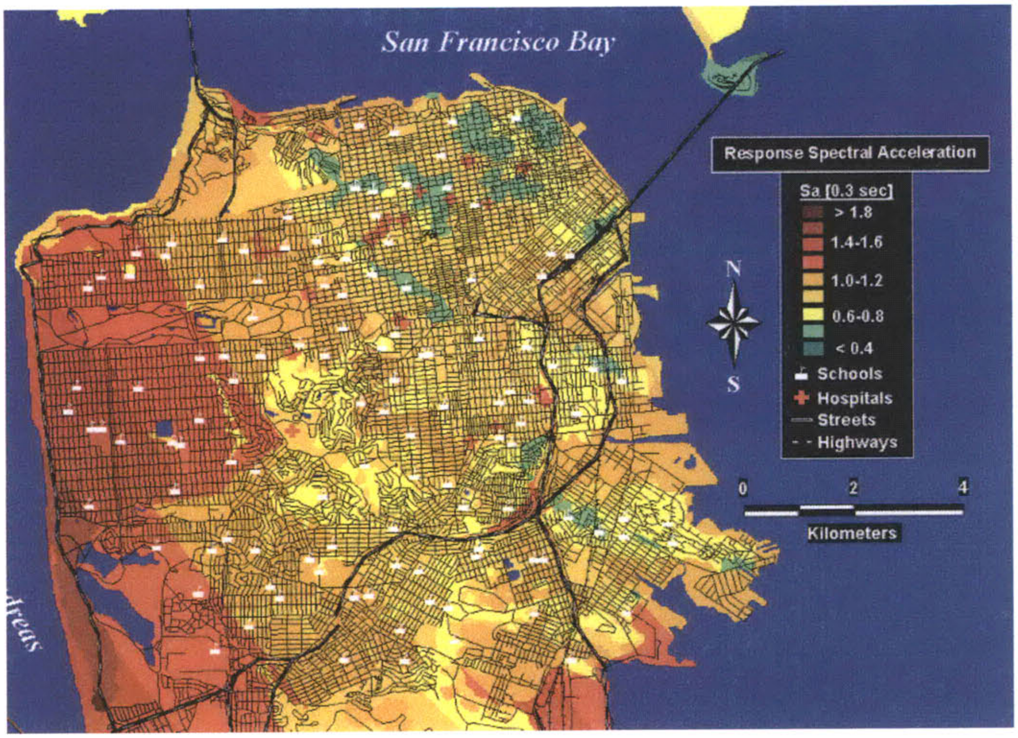
Table 2-XI
MRI Minutes [a]

	MRI Changes 2002-2006		
	Total Minutes	*Inpatient Minutes*	*Outpatient Minutes*
pga	11,643	1,015	10,628
	(7,771)	(4,814)	(5,016)
pga * For-Profit	-11,173	-768	-12,787
	(10,375)	(5,864)	(6,405)
pga * Public	-13,555	-3,486	-7,686
	(9832)	(4,723)	(6,405)
For-Profit	10,888	3,514	7,373
	(5,458)	(3,200)	(3,491)
Public	4,789	2,215	2,574
	(5,094)	(2,378)	(3,852)
Multi-Site	-3,887	-3,446	-541
	(2,220)	(1,577)	(1,176)
Rural	1052	2,091	-1,039
	(3,548)	(1,411)	(2,661)
Teaching	5,076	2,604	2,472
	(1,956)	(1,285)	(1,113)
Licensed Beds	1361	805	556
(per 100)	(319)	(191)	(186)
Age	70.2	-112	182
	(321)	(104)	(249)
Age Squared	0.372	1.48	-1.11
	(2.48)	(0.862)	(1.89)
R-squared	0.099	0.044	0.056
Observations	347	365	347

[a]Notes:

1. All regressions include the number of licensed beds in 1992 and dummies for 1992 ownership status (government-owned or for-profit with not-for-profit status excluded), license age as of 1992 and its square, rural status, 1996 teaching status, 1996 multi-hospital system status and county location. Standard errors are clustered at the city level.

Appendix Figure 2-3: A map of expected ground acceleration in the event of an earthquake similar to the great quake of 1906.



Source: U.S. Geological Survey

Table 2-XII
Hospital Closures: 1992-1996 [a]

	Probability of Hospital Closure			
	Probit (Marginal Effects) (Prob.=0.069)		*OLS (Prob.=0.036)*	
pga	-0.006		-0.013	-0.010
	(0.005)		(0.080)	(0.071)
pga * For-Profit				-0.056
				(0.103)
pga * Public				-0.056
				(0.176)
For-Profit	0.060		0.064	0.036
	(0.051)		(0.026)	(0.095)
Public	0.010		0.033	0.061
	(0.008)		(0.026)	(0.072)
Adj. R-squared	-	-	0.048	0.043
Observations	231	-	443	443

[a]Notes:

1. All regressions include county fixed effects as well as the number of licensed beds in 1992, the hospital's license age in 1992 and its square, 1992 ownership status (government-owned or for-profit, with not-for-profit status excluded), and rural status. Standard errors are clustered at the city level to allow for spatial correlation.

Chapter 3

Judge Specific Differences in Chapter 11 and Firm Outcomes

Joint with Antoinette Schoar

3.1 Introduction

Chapter 11 of the U.S. bankruptcy code aims to provide court protection to distressed firms that are economically viable in order to avoid inefficient liquidation and maintain firms as going concerns. It has been praised as one of the cornerstones of effective company restructuring in the US.[1] Indeed, many countries have tried to emulate the US system of Chapter 11 in order to provide companies with a fresh start and encourage entrepreneurship. Yet the recent surge in bankruptcy filings in the US and the lengthy process of Chapter 11 resolutions has rekindled the discussion about the optimality of the Chapter 11 process.

An efficient bankruptcy process has to strike a delicate balance. On the one hand it must give creditors enough tools to preserve the bonding role of debt by penalizing managers and shareholders adequately for poor performance, prevent inefficient

[1] As cited in Smith and Stromberg (2005), the United Kingdom, Japan, Germany, France and Sweden have all recently instituted 'more debtor-friendly, U.S. styled reorganization codes into their bankruptcy laws.... Indeed, the World Bank, International Monetary Fund (IMF), and the European Union (EU) now encourage member countries to adopt bankruptcy laws that have a reorganization code as one of their cornerstones.'

continuation of non-viable companies and preserve the incentives for entrepreneurs to repay their debts. On the other hand, the process should allow management to prevent inefficient liquidation and asset stripping by creditors when the firm is viable as a going concern. Hart (1999) discusses these goals of an efficient bankruptcy procedure and points out the inherent tension between them in designing of a bankruptcy regime. This tradeoff is based on two types of inefficiencies that can arise in the negotiations between the different claim holders.[2] Since debt holders do not participate in the upside of the firm, the interest of debt holders is to preserve the collateral value of the firms assets rather than allowing new, risky investments. Moreover, given that debt holders are senior in liquidation, they have a claim on any additional investment that is made. This also can lead to underinvestment and inefficient liquidation once the firm is in distress, since effectively the old claimholders constitute a tax on any new investor, as pointed out by Myers' (1977) debt overhang argument. In contrast, equity holders favor overinvestment and inefficient continuation; due to limited liability they benefit from risk shifting a la Jensen and Meckling (1976). This view of firm restructuring would predict that a change towards a more debtor friendly regime (which gives more bargaining power to debt holders) leads to more continuation and investment while a more creditor friendly regime leads to more liquidation.

In this paper we test whether this basic hypothesis reflects the reality of how changes in the bargaining power of either creditors or debtors affect resolutions of Chapter 11 in the US. Surprisingly our findings are exactly opposite to the simple tradeoff laid out in previous paragraph. Indeed contrary to the simple theory, we find that increasing the *debtor friendliness* of the current Chapter 11 process leads to an *increase* in firm shut downs, higher re-filing rates and lower credit ratings and sales growth of the firms that survive Chapter 11. We find the opposite results for an increase in the creditor friendliness. These findings suggest that on average creditors rather than debtors seem to be the ones who are pushing for restructuring solutions in Chapter 11 that allow for more successful continuation of the firm.

[2]See for example Gertner and Sharfstein (1991) for a theoretical analysis of the incentives of debt and equity claims in Chapter 11 resolutions.

The challenge in testing the causal impact of the debtor (creditor) friendliness of the bankruptcy process is to find exogenous variations in the bankruptcy environment, since observed bankruptcy rulings and outcomes could be simultaneously driven by unobservable characteristics such as the difficulty of the case. In this paper we exploit the large heterogeneity among US bankruptcy judges in their interpretation of the bankruptcy laws as an instrument for the debtor (creditor) friendliness of the bankruptcy environment that a company faces in Chapter 11. We can estimate these fixed effects in a meaningful way since, both court procedure and our analysis of the data, show that cases are randomly assigned to judges. While bankruptcy law is set at the federal level, we show that the interpretation (application) of the law varies largely across judges. Among the judges in our sample there are significant differences in the likelihood of granting or denying motions that favor either creditors or debtors. In fact, we find a strong *systematic pattern* that judges either tend to rule in favor of or against creditors across all types of motions. These findings suggest that the particular judge that a firm draws in Chapter 11 is a significant determinant for how the laws are applied. We can therefore use the specific judge as a proxy for whether the Chapter 11 process is marginally more (less) tilted towards the debtor or the creditor. The existence of robust judge fixed effects is consistent with Bris, Welch and Zhu (2006) and their discussion of the existence of 'behavioral difference among judges.' Using more detailed case information on a smaller number or cases, they find statistically significant differences across judges 'in terms of the fraction that they pay out to creditors, how they adhere to APR, and how many days the proceedings take.'

We then use these estimated judge fixed effects to build an index which classifies the debtor or creditor friendliness of a given judge across all his rulings in Chapter 11. We classify any motions as pro-debtor that aim to prevent asset stripping and encourage follow-on investment to maintain the firm as a going concern. Specifically (D1) the automatic stay, which prevents secured creditors from taking out their asset from the firm and ensures that all debt service to the creditors is withheld. (D2) The exclusivity period which mandates that during the first 120 days of bankruptcy, only the debtor can submit a restructuring proposal. After the first 120 days the judge can either extend the exclusivity period or allow creditors to submit their own proposal. (D3) Use of cash collateral, which gives the judge the authority to grant debtor in possession to use cash collateral to maintain the firm as a going concern. Vice versa we classify a judge as pro-creditor if he or she scores high on motions that allow creditors to maintain their asset value, e.g. lifting the automatic stay, granting the conversion to Chapter 7 or denying the extension of the exclusivity period.

This index allows us to analyze the marginal impact of a move towards a more debtor-friendly (or creditor-friendly) Chapter 11 workout. As discussed before, we would expect that a firm which is allocated to a judge who scores low on the pro-debtor index should lead to less continuation (even efficient continuations), since creditors care for the protection of their assets. In contrast, equity benefits most when the firm survives as a going concern and thus a pro-debtor environment should show a higher rate of continuation. We actually find the opposite: An increase in the debtor friendliness of the workout environment leads to higher shut down rates and more re-filings of firms after coming out of Chapter 11. Moreover, we find worse outcomes post-Chapter 11 for those firms that were restructured in a pro-debtor workout environment. These firms show a greater decrease in sales and employment level in the years following Chapter 11 relative to firms with pro-creditor judges and a worsening credit rating going forward.

These findings are very surprising: Bankruptcy workouts where the creditors have more power relative to those where the debtors have more power increase the likelihood of continuation and show better performance ex post. This outcome is not mechanically driven by survivorship bias, i.e. that pro-creditor judges have a higher hurdle rate in whom they let through Chapter 11 and thus the few surviving firms are of better quality. To the contrary, we find that fewer firms are shut down in Chapter 11 under a pro-creditor judge.

What can explain these counter-intuitive results?

One interpretation is a governance failure in firms that enter distress; in particular equity is not adequately represented by management in the bankruptcy process.

Governance problems between shareholders and management might result in the destruction of assets in the bankruptcy process, since management might use the process not to restructure the firm in the interest of shareholders but to use the Chapter 11 process maximize their private rents. For example, Weiss and Wruck (1993) argue in the context of the Eastern Airlines bankruptcy that a debtor friendly bankruptcy judge allowed for excessive asset stripping to prevent the shut-down of the firm. Additional empirical support for this argument comes from Betker (1995), who provides evidence that management uses its ability to draw out the bankruptcy process as leverage in negotiations with creditors, at times to the detriment of equity.

Alternatively, if equity has the de facto control rights, a restructuring process that is tilted towards debtors could allow equity itself to extract financial resources from the firm (instead of keeping assets tied up in firm). Owner-managers who are in control of day-to-day management would be able to take the most important assets or human capital out of the firm and thus avoid having to share future income with existing claim holders. For example extending the exclusivity period, or allowing the use of cash collateral and asset sales, may allow equity holders to circumvent creditors and pay themselves in bankruptcy. If this extraction technology for equity is not too costly, maintaining the firm as a going concern might not be the most attractive option. In contrast, (unsecured) creditors cannot engage in this type of behavior since they do not have de facto control rights in the firm, and thus have to preserve the firm as a going concern.

Our results suggest that ignoring these important governance implications in the analysis of firm restructuring can result in policy recommendations that lead to conunter-intuitive results. In situations where agency problems within firms are particularly severe, equity holders and minority shareholders might be better protected by creditors rather than management in times of distress.

Finally we want to be cautious to delineate what we can and cannot say about the efficiency of the bankruptcy process based on the findings in this study. Our identification strategy allows us to shed light on how a change in the debtor (creditor) friendliness of the workout process in Chapter 11 affects the ex post performance of distressed firms. However, we cannot say anything about the ex ante incentive effects of a change towards a more creditor (debtor) friendly judge, since the identity of the judge is not known to the parties at the time they write contracts, or make lending decisions.

3.1.1 Literature Review

Our paper contributes to the debate about Chapter 11 in a number of ways. First we provide a novel instrument to estimate the causal impact of greater debtor (creditor) friendliness for the workout process between creditors and debtors. These findings build in on the earlier literature starting with Hotchkiss (1995) who looks at the performance of 197 public companies post Chapter 11 and finds little evidence that the process effectively restructures distressed firms. She concludes that it is consistent with the view that "there are economically important biases towards continuation of unprofitable firms." Firm performance in the three years following bankruptcy was worse if management was not replaced. For a similar conclusion see Gilson (1993). On the other hand Baird and Rasmussen (2002) and Skeel (2003) argue that contractual developments have allowed creditors to "neutralize" inefficiencies due to the pro-debtor nature of Chapter 11, and that creditors "have managed to undue such biases through private contracting."[3]

Internationally, Thorburn (2000) finds that Sweden's more creditor friendly auction based bankruptcy system leads fewer deviations from absolute priority, lower cost, and are resolved faster than the U.S. Chapter 11 cases. In contrast Ravid and Sundgren (1998) examine the relative efficiency of the "creditor-oriented old Finnish bankruptcy code and the debtor-oriented US code" and finds that U.S. reorganizations are more efficient.

The role of agency issues between equity holders and managers in Chapter 11 has been widely investigated in the law literature. For example, Bradley and Rosenzweig

[3]Skeel (2003) specifically sites the "use of debtor-in-possession financing agreements as a governance lever; and the so-called pay-to-stay arrangements which give key managers bonuses for meeting specified performance goals" as the two key contractual developments since the 1980s.

(1992) suggest that "bankruptcy law fails to provide managers with appropriate incentives to allocate corporate resources to their highest-valued uses, but instead rewards managers for taking inefficiently high risks. Betker (1995) argues that management has the real control in Chapter 11 and their interests are not always aligned with their shareholders. He provides some empirical evidence to support his idea by looking at cases where CEO pay and shareholder wealth were negatively related and show that management incentives correlate with violation of absolute priority. Eckbo and Thorburn (2003) show that reputation effects temper CEO taste for excessive risk taking in Swedish automatic bankruptcy auctions. Franks and Torous (1994) compare creditor recovery rates during distressed exchanges and Chapter 11 reorganizations. They find creditors have lower recovery rates in Chapter 11, and argue that there is a high cost (to creditors) to formal reorganization.

Among others, Berglof and von Thadden (1994), Dewatripoint and Tirole (1994) and Bolton and Scharfstein (1996) find that in a world of incomplete contracts, having multiple creditors (or investors) can lead to increased ex ante efficiency at the cost of ex post efficiency. Kahl (2002) argues that the poor performance of firms post debt-restructuring is not due to coordination problems among creditors, or an inefficient bankruptcy process, but instead are simply the result of the dynamic learning strategies of creditors. Ayotte (2007) examines a model of bankruptcy for entrepreneurial firms, and suggests that when the value of the firm as a going concern is dependent on the effort of an owner-manager, ex-post efficiency is best served by a "fresh start" for the indebted entrepreneur. The current paper shows that the objectives of equity holders seem to be more effectively represented by creditors than by management, because of governance problems within the firm.

More directly relevant to our paper is the role of individual bankruptcy judges and their influence over bankruptcy cases. In an analysis closest to our own in terms of the methodology and data, Bris, Welch and Zhu (2005) find significant behavioral differences across judges in terms of the fraction paid out to creditors, adherence to absolute priority, and case length. LoPucki and Whitford (1993) state that with the level of discretion afforded bankruptcy judges, "a skilled, aggressive bankruptcy judge who wished to do so could wield virtually complete power over the governance of a reorganizing company. Based on interviews and independent analysis, LoPucki and Whitford concluded that in over a quarter of the cases in their sample, the judge did indeed choose to play a "major role in the case. To quote from Aghion, Hart and Moore (1992) "placing decisions in the hands of representatives - and indeed the supervising judge - creates agency problems... Judges too can use their supervisory powers to pursue their own agendas, which may be in conflict with the claimants' narrow objective of value maximization.

3.1.2 Identification Strategy

To undertake this study, we collected information on all Chapter 11 filings of small businesses in six US district courts: Arizona, California (LA), California (ND), California (RS), California (SA), California (SV), Delaware, Northern Georgia, and New Jersey.[4] Ultimately we obtain a sample of 4857 cases across 59 judges. The data was collected from the PACER (Public Access to Court Electronic Records) web sites. Started in 1990, PACER was Federal Judicial Conferences response to a Congressional Mandate to provide reasonably priced public access to court records in electronic form. For each case we coded the most important decisions (motions and rulings) that the judge ruled on during the Chapter 11 hearings. For example, we code whether the lifting of an automatic stay was granted or denied, whether the use of cash collateral was granted or denied, whether the judge decided to convert the case into another chapter, etc. To be able to handle the enormous volume of this task the coding was done through a computerized algorithm and then cross checked by hand to validate the findings. We supplement this information with data from Dun & Bradstreet on the observable characteristics of the firms that are filing for Chapter 11.

It is important to note that our identification strategy relies crucially on the assumption that cases are randomly assigned to judges in Chapter 11. However, we are not imposing random assignments *across* different bankruptcy courts, but just

[4]We are currently in the process of extending the data to more than 60 additional district courts.

between judges *within* a given district court. This assumption seems well in line with the provisions of the law. While a large literature has shown that there seems to be significant forum shopping across jurisdictions, judge shopping is widely condemned and actively discouraged, see for example Eisenberg and LoPucki (1999). The bankruptcy courts within our sample state that they are using a random assignment rule to allocate cases to judges. Moreover, our empirical tests corroborate this assumption.

We first verify that firms indeed are randomly allocated to firms. For that purpose we show that there are no significant difference in the sales, number of employees or credit rating of cases across judges. The F-tests on the judge fixed effects show that there are no significant fixed effects in the observable characteristics of Chapter 11 cases that judges are assigned to. When we redo these tests at the district by district level we find that random assignment holds in all district courts, but we have some suggestive evidence that it is less strong in Delaware. However, the results for Delaware might be less representative since Delaware has a very large number of pre-pack Chapter 11 filings which we cannot include in our estimation since there are no data available through PACER on the rulings or outcomes in these cases. Throughout the paper we therefore make sure that all our results hold when we exclude Delaware from the sample.

In the second step we repeat a similar set of regressions for the different rulings of judges in Chapter 11, for example granting or denying the lift of an automatic stay, the use of cash collateral, the dismissal of the case. One by one we regress the judges decisions on a set of judge fixed effects and district times year effects. We find that there are significant differences in how judges rule in Chapter 11. We find a significant F-test for almost all of the judges' decisions. In particular we find strong differences on some of the more prominent decisions such as granting or denying the lifting of an automatic stay or allowing the use of cash collateral. The results do not change if we include firm level controls for size, number of employees or industry, as suggested by the random assignment results established above. These findings are quite remarkable since they suggest that judges indeed differ systematically in their likelihood to rule in favor of creditors or debtors in Chapter 11.

For the interpretation of our results it is important to note that while we show that cases seem to be randomly assigned to judges in Chapter 11, the different parties in bankruptcy, especially the lawyers who representing the creditors or the management, might know the reputation of the judge to which they were assigned. Given their expectation of succeeding with a specific motion, the different parties in bankruptcy might endogenously choose whether or not to file a motion in the first place. Take the case of a very strict judge who is known to only very rarely allow an extension of exclusivity or to lift an automatic stay. In that case the lawyers of the different parties in bankruptcy might not even try to file a certain motion, since they expect rejection and vice versa in the case of a judge who is considered more permissive. Therefore, a permissive judge might not only have a higher number of approvals, but even a higher number of denials, since he will see more marginal requests than a judge with a less permissive reputation. However, because of this endogeneity in the number of filings we cannot use the *fraction* of approved motions or the *number of denied* motions as an indicator for judge bias. Therefore, only the *number* of approved motions is a well defined indicator of judge bias in our set up.

The remainder of the paper is structured in the following way; section II discusses the filing process in Chapter 11, section III describes the data used in the current paper, section IV displays the analysis and results of the paper and finally section V concludes.

3.2 The Chapter 11 Process

Chapter 11 bankruptcy protection is an attempt to allow firms which are in financial distress but otherwise are viable as going concerns to restructure their financials and their physical assets in order to keep operating. The aim of Chapter 11 is to prevent (unsecured) creditors from stripping the assets of the firm when it is socially optimal to allow the firm to continue, i.e. if the value of the firm as a going concern is higher than its liquidation value. Many practitioners therefore describe Chapter 11 as a fresh start for the firm. To avoid such a run in Chapter 11 an automatic stay is places on the assets, but the bankruptcy judge had the power to lift the stay. So the bankruptcy judge invariably has a lot of power within the process.

If the judge assigned to a case does not feel the firm meets this requirement, then the case is summarily converted to a Chapter 7 liquidation bankruptcy or dismissed altogether. Conversions and dismissals of this type are quite common and approximately half of all bankruptcy cases never reach the hearing stage.

Chapter 11 formally begins with the filing of a petition in district bankruptcy court. Although such petitions are almost always filed by the debtor, creditors meeting certain requirements may force a firm to file for involuntary bankruptcy. In addition an increasing number of cases are filed 'pre-packaged'. Essentially prepackaged cases are ones where the debtor files a petition with a reorganization plan that has already been negotiated by the firm, its creditors and if relevant, voted on by stockholders. For the purpose of this paper we will not include pre-packaged bankruptcy cases, since those cases do not allow for any action from the part of the judge.

After filing, Chapter 11 consists of three main parts. The first consists of the presentation of a plan of reorganization. Under Chapter 11 U.S. Code Section 1121, the debtor in possession has a 120 filing day 'exclusive period' during which they have the sole right to file a plan of reorganization. If the debtor has failed to file a plan during the first 120 filing days, the debtor can request to extend their exclusive period. If their request for an extension is denied, other parties may file their own plan for firm reorganization. Once a plan as been filed, creditors and equity holders vote to confirm the plan. A plan is considered confirmed when a majority consensus is reached as measured both in the number of creditors and fraction of the total debt owed. Finally once a plan has been confirmed, the process of reorganization begins with the implementation of the now approved plan of reorganization. Once completed to the court's satisfaction, the case is officially closed and the bankruptcy process is considered complete. Although on average this process takes approximately two years, it can take much longer depending on the complexity of each particular case.

Successful reorganization should allow a firm to operate as a financially viable entity. As such re-filing, even more than firm dissolution, can be seen as the ultimate failure of the bankruptcy process.

3.3 Data Description

The data for this paper stem from three main sources: (1) The Public Access to Court Electronic Records (PACER) electronic public access service, (2) Dun & Bradstreet and (3) the National Establishment Time-Series (NETS) Database.

First, we obtain full case histories including the case docket from PACER. PACER is an internet based service which provides registered users with access to case and docket information for bankruptcy cases.[5] Although the PACER service is run federally by the Administrative Office of the United States Courts, each district is responsible for maintaining its own separate website and database of case information. As such the content and quality of information provided varies by district.

Our PACER data universe consists of all Chapter 11 bankruptcies available during the summer of 2004 from the PACER system for the districts of Arizona, California (LA), California (ND), California (RS), California (SA), California (SV), Delaware, Georgia (North) and New Jersey. The dataset includes approximately 11,000 cases filed and completed between 1989 and 2003 for private and public companies. After dropping pre-packaged cases, Dun & Bradstreet were able to match 6,266 cases to 6089 distinct firms in their data universe.[6]

The PACER system allows authorized users to download the complete docket information for cases filed in Bankruptcy court. To deal with the enormous size of the sample, we utilized a computer algorithm to parse through the docket information and code the individual motions and decisions that a judge ruled on. We concentrate on 18 rulings that from our reading of the legal literature on the Chapter 11

[5]We thank the participating district courts for their generosity in waiving the fees for accessing their PACER entries.

[6]Dun & Bradstreet were able to match 8,000 cases to firms, but we chose to drop those matches Dun & Bradstreet did not designate as "high confidence" matches.

process are considered most important.[7] For that purpose we construct a large number of indicator variables which take up the values 0 and 1 depending on whether a judge makes that type of ruling in a case. The most important decisions taken by bankruptcy judges are orders to (1) dismiss a case, (2) convert a case from Chapter 11 to Chapter 7, (3) grant an extension of the exclusivity period, (4) grant a lift of the automatic stay, (5) allow the debtor to use cash collateral and (6) allow the sale of assets. Table 3.5 shows that cash collateral requests are granted in only 1.4% of the case and denied in over 32%; conversion to chapter 7 happens in about 2% of the cases and denied in less than 1%; dismissal is granted in only 3% of the cases and denied in about 74%; lifting a stay is granted in 8% of the cases and denied in 32%; and finally the granting and denying a sale both appear with a probability below 1%.

For each case in our sample, we then examined the entire docket coding by hand to verify that the extract filings correspond to the actual rulings. We were especially careful to check that the algorithm did not suffer from type II errors and excluded valid motions. However, since a majority of the district courts only switched to fully electronic filing during the year 1997. To avoid any sample selection biases from differential adoption of PACER we replicated all our tests using only the sub-sample starting in 1998 and our results are unchanged. We include Chapter 11 filings of private as well as public companies, with the majority being private firms. The frequency of the filing events by year and district are presented in Table 3.4.

We also obtain information on the re-filing rate (and date) of cases that had previously gone through Chapter 11 if they happen within our sample period. About 2.9% of the cases in our sample land in bankruptcy court again. On average the firms that refile take about 1.1 years before re-enter bankruptcy.

Using the data from Dun & Bradstreet, we were able to obtain some characteristics of the firms in our bankruptcy sample. The D&B data contains information on the sales, number of employees and some financial information for nearly 100 million firms. The benefit of D&B is that it also includes information on *private firms* if these firms ever had a credit record. This will almost by definition be the case for

[7] See for example Baird (2002).

the majority of firms that land in Chapter 11. By using a combination of firm name, address and Tax ID numbers the cases were matched to firm financial records by Dun & Bradstreet. Fourth quarter credit ratings were available for 1317 of these firms for the years 1997-2003. Summary statistics for the cases in our sample are presented in Table 3.2.

The average firm in the D&B sample has sales of $1.7 million, ranging from less than one thousand dollars in sales to over $50 million in sales. Employment range from 0 to 2,500 employees with an average of 22 employees per firm. As we can see from Panel B of Table 3.2 the average firm in the NETS sub-sample tends to be larger than those in the entire sample. NETS matched firms have average sales of $2.7 million, ranging from 15 thousand dollars to over $150 million. Similarly, NETS firms have both a higher average and variance in the number of employees. In comparing the two data sets we find that the main observable differences between the D&B universe and the NETS data is that NETS data have significantly higher sales, only slightly higher employment and significantly higher credit ratings and incorporation rates, all of which might be driven by the difference in average firm size.

3.4 Random Assignment

As discussed above our identification strategy will rely crucially on the assumption that in Chapter 11 cases are randomly matched to judges. If the assumption of random assignment was violated, judge specific effects could not be meaningfully estimated. Instead the observed ruling of a judge might reflect the demands of the case and not the judge's judicial philosophy or biases. For example, imagine one judge who is specialized in difficult cases and another judge in simpler bankruptcy cases. Then the judge with the more difficult cases might appear to rule more often to allow an extension of the automatic stay which could be misinterpreted as having a pro-debtor bias. However, under this scenario a large fixed effect for the judge with the difficult cases could rather be driven by the fact that difficult cases more often require the extension of the automatic stay, since the parties in the case cannot agree on a compromise.

In theory, random assignment of cases to judges seems a very reasonable assumption. Procedurally judges within a district randomly draw new cases from the pool of pending applications. [8] Therefore although firm characteristics might depend on the district in which the firm operates, *within* districts, firms and judges should be randomly paired. [9] If the set of cases assigned to each judge is comparable, differences in rulings can then be interpreted as the result of judge specific effects.

By law a firm is only allowed to file for bankruptcy in districts in which it operate. Since most small firms have operations in only one district, they do not have a choice which district to file in. This is different for large firms that have operations in several states and district and thus might be able to engage in so called forum shopping. Therefore throughout the paper we make sure all our results hold when we exclude when we exclude the top deciles and quartile of firms by sales.[10] Within a given district the procedures of most bankruptcy courts prescribe that cases are randomly assigned to available judges. Moreover, when we talked to the clerks of several of the participating bankruptcy courts they verified that this is the procedure they follow.

One might be worried, however, that even if the courts use random assignment to decide which judge precede a given case, the timing of filing of cases is not. For example, knowledgeable bankruptcy lawyers might know when a given judge has a light case load and thus file at a strategic time to obtain a higher chance to be assigned to this judge. For that purpose we test the assumption of random assignment more directly. We run a regression of different characteristics of the firms that end up in Chapter 11 on the set of judge fixed effects. The observable characteristics that are

[8] An exception to this method occurs when two or more cases are related. Although the assignment of related cases is not random, as long as the initial case is randomly assigned, effective randomization should still occur. New Jersey explicitly states their rule for case assignment in D.N.J. LBR 1073-1(d): 'If the petition commencing a case states in writing that the case is related to another case which has been or is being filed in the same vicinage, the clerk shall assign the case to the judge to whom the lowest numbered related case has been assigned. All other case assignments shall be made by the random draw method used by the Court.'

[9] see Eisenhard and LoPucki (1999) for a discussion of random assignment in Chapter 11.

[10] Excluding the top decide or quartile of firms by sales have no significant effect on any of our findings. This should not be seen as evidence either for or against the existence of forum shopping. Rather it merely suggests that forum shopping by the multi-State firms simply does not lead to a significant change in the overall composition of bankruptcies filed in any given district.

available to us are the annual sales of the firm, the number of employees and the credit rating at the end of the year in which the firm filed for bankruptcy. We also need to control for an interaction of district and year fixed effects. This control is important if the case load and composition of cases changes over time in a district. Therefore a control for the changes in the composition of cases that come to the court in a given period is required.

Specifically for each type of filing, we estimate the following regression:

$$y_i = \alpha_{dt} + \gamma_i + \beta X_{it} + \lambda_{judge} + \epsilon_i \tag{3.1}$$

where y_i is a dummy for whether a particular order was issued, α_{dt} are district varying year fixed effects, γ_i is a dummy for whether the case was filed voluntarily, X_{it} represents a vector of district varying firm level controls and ϵ_i is an error term. The remaining term λ_{judge} is the fixed effect of each judge. This fixed effect can be seen as the relative rate at which each judge grants or denies a particular motion. Because each judge serves in only one district[11], district effects are not included as they would be perfectly collinear with judge fixed effects. Therefore, whenever we need to directly compare individual fixed effects across our different districts, the fixed effect coefficients are demeaned at the district level.

Panel A of Table 3.6 shows the results from an F-test on the set of judge fixed effects from a regression of the logarithm of sales on the specification described above. We see that the F-statistic is small and rejects the hypothesis that the judge fixed effects are jointly significant. As seen in Table 3.6, there appears to be no evidence that judge fixed effects jointly explain average sales. We then repeat these tests for the number of employees. Again we find that the F-test on the joint significance of the judge fixed effects is not significant. These results also hold true if we estimate judge fixed effects for each individual district separately. We also re-estimate the judge fixed effects for different subsets of the data, windsorizing either at the 5%, 10% or 20% hurdle and get quantitatively similar results.

[11]One judge did have a small fraction of her cases in a second district. Those cases were dropped from our sample.

In Panel B of Table 3.6 we replicate the results for the smaller sample of NETS data. The results again are qualitatively unchanged; again we do not find evidence that judge fixed effects are jointly significant in explaining how cases are allocated to judges. These findings hold if we leave out each individual district, remove all judges with fewer than 10, 15 or 20 cases, or drop the (in)voluntary cases. We also find that these results are robust to dropping all cases that were filed prior to 1998. As discussed above, the number of courts that adopted the PACER system was very small prior to 1997.

Overall these results suggest that there is random assignment of Chapter 11 cases to judges and thus case allocation is independent of the firms' observable characteristics, such as firm size, measured as sales and employees at the time of filing. Given the stated allocation rules of bankruptcy courts, these findings reassure us that firms are not matched to judges in some measurably biased way. This is a very powerful result since it will allow us to estimate judge fixed effects on the decisions they take and interpret them as a reflection of the judges specific leanings or biases and not an outcome of the type of cases that are allocated to the judge.

3.5 Judge Specific Differences

Since we are able to verify that cases are randomly assigned to judges, we can now estimate whether there are judge specific fixed effects in the way judges rule in Chapter 11. To test whether judges vary systematically in their approach to Chapter 11 rulings, we repeat an estimation strategy parallel to the one used above. As dependent variables we use the different motions a judge approves or dismisses during the Chapter 11 process. For example, we regress an indicator for whether a judge grants a creditor's motion for relief from the automatic stay on the set of judge dummies and the interaction of year and district fixed effects. We then conduct an F-test for whether the judge fixed effects are jointly significant. We repeat this estimation procedure separately for all judge decisions.

The results from this exercise are markedly different from the results in the previous section. In fact, almost all the F-test on the different judge decisions are jointly significant. Table 3.5 shows that F-tests on most of the judge decision variables are large and significant. Specifically we find large and very significant F-tests for the granting and denying of motions requesting the use of cash collateral, granting and denying motions to convert the case to Chapter 7, granting and denying of motions for dismissals and granting and denying motions for relief from the automatic stay. According to the bankruptcy literature these are very important decisions in Chapter 11, see for example Gertner and Scharfstein (1991). In contrast, we find that the F-tests tend not to be significant for those rulings that are rarely utilized, such as granting a sale of assets or an extension to the exclusivity period. Both of these rulings occur in less than 0.5% of the bankruptcy cases, which suggests that the incidence rate of these motions if too low to find significant results.

These results hold if we include firm level controls in the regression such as logarithm of sales, number of employees or industry fixed effects. This is not surprising since we had previously shown that judges are randomly assigned to cases. Moreover, we again repeat the regressions for the smaller sample of NETS data. The results are very similar to the findings in the full data set but slightly noisier. This is not surprising since the power of the test is much lower, as we are loosing more than 50% of the observation when using the NETS dataset.

Overall, these results suggest that there is large and significant heterogeneity in the propensity of judges to grant a given motion. This finding demonstrates that depending on which judge is assigned to a given case the rulings on the case varies dramatically. In the appendix we report the estimated fixed effects for the individual judges. We see that in the cases where the F-test is highly significant, even the t-tests on the individual fixed effects are significant for most of the fixed effects. So a judge who has a particularly low estimated fixed effect has a lower than average propensity to grant a particular motion. And a judge who is at the higher end of the fixed effect distribution has also a higher propensity to grant the motion. Put simply, judges play a central role in how bankruptcy law is applied to an individual case.

Finally, for the interpretation of our results it is important to note that while we show that cases are randomly assigned to judges in Chapter 11, the different parties in bankruptcy, especially the lawyers who represent the creditors or the management, might know the reputation of the judge they were assigned to. Given their expectation of succeeding with a specific motion, the different parties in bankruptcy might endogenously choose whether or not to file a motion in the first place. Take the case of a very strict judge who is known to only very rarely allow an extension of exclusivity or to lift an automatic stay. In that case the lawyers of the different parties in bankruptcy might not even try to file a certain motion, since they expect rejection and vice versa in the case of a judge who is considered more permissive. Therefore, a permissive judge might not only have a higher number of approvals, but also a higher number of denials, since she will see more marginal requests than a judge with a less permissive reputation.

Because of this endogeneity in the *number* of filings we cannot use the *fraction* of approved motions or the *number of denied* motions as an indicator for judge bias. Therefore, only the *number* of approved motions is a well defined indicator of judge bias in our set up. Therefore, going forward we will only use the fixed effects on the number of granted motions as an indicator for a judge's bias.

3.6 Pro-debtor and pro-creditor index

So far we have shown that there is significant heterogeneity in how judges rule on specific provisions in Chapter 11. We now want to understand whether there are consistent patterns in the rulings of judges *across* different petitions. So for example, does a judge who has a strong positive fixed effect on granting extensions of the exclusivity period also displays pro-debtor tendencies on other provisions, e.g. allows the use of cash collateral or never lifts the automatic stay. In contrast, one could imagine that judges have personal judicial philosophies in how they apply certain rulings but no consistent bias.

To test the correlation structure between different judge fixed effects we conduct a principal component analysis. As discussed above we only include fixed effects on the petitions that are granted by a judge but not those that were denied. We include the most important rulings in the Chapter 11 process that can be clearly characterized as pro-debtor or pro-creditor. Under the rather reasonable assumption that no party would request something harmful to itself, we classify motions that are mostly requested by creditors as pro-creditor and those submitted by debtors as pro-debtor. We include eight types of motions that are filed exclusively by either the debtor or creditors. The debtor filed motions are request for (D1) the use of cash collateral, (D2) extensions to the exclusivity period and (D3) the sale of assets, and (D4) objections to the plan of reorganization by creditors. The creditor filed motions are requests for (C1) case dismissal, (C2) conversion of case to Chapter 7, (C3) lifting the automatic stay, and (C4) objections to the reorganization plan by debtors.

We find a very consistent structure in our principal component analysis. The first principal component is by far the most important one and explains about 40% of the variation across judge fixed effects. This component loads very positively on the motions that are pro-debtor (D1 to D4) and also loads very negatively on the motions that are pro-creditor (C1 to C4). These findings suggest that judges are very consistent in how they rule on motions, i.e. across the different motions a given judge shows either a systematic bias towards the debtors or the creditors.

This finding also suggests that we can combine the judge's bias (the size of the judge fixed effects) across different motions to create a proxy for his or her overall tendency to rule in favor of the debtor or creditor. To capture whether or not a judge displays a pro-debtor bias (leniency) we create an index using a combination of the estimated judge fixed effects. We combine the judges fixed effects on the six motions and two objections which we can classify as pro-debtor or creditor into an index. For that purpose we assign a dummy equal one to any judge who scores above the median on one dimension of fixed effects and a minus one for any judge who scores below the median. We repeat this classification for all the eight events. Finally we sum the dummies on the pro-debtor motions and subtract those on the pro-creditor motions. This index ranges from eight for the most pro-debtor judge to minus eight for the most pro-creditor judges. An important intrinsic assumption this index makes is that each of our eight motions are equivalent signals of a judge's bias. That is the bias a judge shows in granting case dismissals has the same weight as granting extensions of the exclusivity period. Although this is likely an oversimplification, it has the advantage of not relying on exogenous assumptions about a motions relative signaling value.

We also include a second set of indicators to characterize the judges' biases in Chapter 11. It may be the case that motioned filed by one side (debtors or creditors) have more of an effect than the other. For that reason we also create a second set of dummies that counts the pro-debtor motions separately from the pro-creditor motions. In a parallel proceedure to the one described above, we create an indicator (PD) that sums up the judge's fixed effects on the motions that favor debtors (D1-D4). We the repeat the process to create a separate indicator (PC) for the judges fixed effects on the motions that favor creditors (C1-C4). Both these variables run from +4 to -4.

3.6.1 Effect of Pro-Debtor or Pro-Creditor Judges

In Table 3.7 we report the results of a regression of different outcome variables on the pro-debtor/creditor index controlling for district and year effects. We see that pro-debtor judges increase a firm's chances of re-filing by 1.7%. Since the re-filing base rate in our sample is only 3.0%, this represents a substantial increase in the propensity to re-file. In column (2) we then replicate the regression using the likelihood of shutdown as the dependent variable. Again we find that pro-debtor judges show a significantly higher shutdown probability (5.6%) than pro-creditor judges. But since the probability of shutdown for firms in our sample is 28.5%, this represents a smaller relative effect than the one we find for re-filing rates. These outcomes are very surprising since one might have expected that pro-debtor judges would have a larger tendency to maintain firms as going concerns. Column (2) replicates these results using the smaller sample of the NETS data. We see that the findings are qualitatively very similar but less significant, since we have reduced power in this much smaller dataset.

In Panel B of Table 3.7 we repeat this estimation but use sales growth, employment growth and change in credit rating post bankruptcy as the dependent variables. Unfortunately, with the exception of the D&B credit rating, we only have a panel data for these dimensions for the reduced sample based on NETS data.[12] Row (1) of Panel B of Table 3.7 are based on the D&B credit rating for the full sample of cases, but unfortunately we only have a limited panel for credit rating in our current D&B data set. Because the credit ratings provided by Dun % Bradstreet are non-linear (credit ratings are integers from 0 to 5), a dummy was created to determine whether a firm's credit rating increased in relation to a reference year. The results show a rather striking pattern where the effect of pro-debtor judges is negative and increasing over time, with significance at four and five years out.

We then replicate the panel regressions in the smaller NETS data set where we can observe changes in sales, employment growth and PAYDEX scores. Using the NETS data set, we find that there is a decrease in sales growth for the pro-debtor judges for all five years after the bankruptcy filing, but the results are only significant in the fourth and fifth year after the initial filing. Similarly we find a negative coefficient on employment growth for each of the five years post-bankruptcy filing, but the results are not significant. Finally we find negative effects of the pro-debtor indicator on the firm's credit rating (PAYDEX min and max are the equivalent of D&B credit scores in the NETS data) but the estimated effects are not significant throughout, we believe that this is most likely because of the reduced data set.

Table 3.8 repeats this analysis, but with the pro-debtor dummy broken into a pro-debtor (D1-D4) and pro-creditor (C1-C4) component as discussed above. The results largely mirror those found in Table 3.7. We again find that pro-debtor judges have higher re-filing rates and a higher fractions of shut downs. Interestingly, these results seem to be driven by the judges' decisions on motions that are pro-debtor, while the judges' scoring on the pro-creditor index are not significant for these outcomes. This suggests that the judge's ruling on the pro-debtor motions is more important for these outcomes than the pro-creditor motions. One additional result in row (2) of Table 3.8 is that a pro-creditor bias leads to an eighteen day reduction in case length. Here the

[12]We are currently trying to get a larger data set of these observable characteristics.

judges' score on the pro-creditor decisions is more significant than the pro-debtor.

These results are very surprising given the prior discussion of the US Chapter 11 process. We defined pro-debtor judges as those that are heavily skewed towards favoring debtors when ruling on motions that can either hurt or help debtors. These motions include for example, extending the exclusivity period, or allowing the firm to use cash collateral to finance ongoing operations. In contrast judges who we classify as pro-creditor allow many more motions that are aimed at protecting the assets of the creditors such as lifting the automatic stay, in the reorganization process. Therefore, we would expect that pro-creditor judges who give more power to creditors, should lead to less continuation (even efficient continuations), since creditors only care for the protection of their assets. In contrast, equity benefits most when the firm survives as a going concern and thus pro-debtor judges should show a higher rate of continuation. However, we actually find the opposite, with pro-debtor judges producing higher firm shut down rates than pro-creditor judges. Moreover, pro-creditor judges had lower re-filing rates and show better outcomes for those firms that do survive post-chapter 11. These findings are very surprising. First they suggest that pro-creditor judges are actually more beneficial for the *continuation value of the firm* than pro-debtor judges. This outcome is not driven by the fact that pro-creditor judges just have a high hurdle rate in whom they let through Chapter 11 and which firms they shut down. This raises a fundamental question why equity holders are not able to protect their interest as a going concern as effectively when the firm is allocated to a pro-debtor judge. One suggestion is that equity is not represented adequately by management in the bankruptcy process.

3.6.2 Differential Effects for Larger Firms and Corporations

To analyze the impact of governance structures on the restructuring process in Chapter 11 we would ideally like to obtain information on the management team of the firms, whether a firm is owner managed or has separation of ownership and management, or other indicators of agency problems within the firm. We would also like to know the composition of secured and unsecured lenders. Unfortunately we currently do not have access to this information. If the counter-intuitive results discussed before are driven by governance problems between owners and managers, we would expect that pro-debtor judges have a more negative effect for larger and incorporated firms, since those are more likely to have separation of management and control. In contrast if the results are due to the fact that pro-debtor judges might make it easier for equity to divert resources from the bankruptcy estate, then the effect should be larger for smaller, owner operated firms.[13] Therefore, we use the size of a firms and its incorporation status as a proxy for the severity of the agency problem within the firm. Our assumption is that smaller firms and those that are not incorporated are more likely to be owner operated and have fewer governance problems.

To estimate the differential effect of a pro-debtor judge on larger or incorporated firms we repeat regressions structure in Table 3.8 but include interaction terms between (1) the pro-debtor index and a dummy for whether a firm is incorporated or not, (2) the pro-debtor dummy and the logarithm of sales of the firm in the year prior to bankruptcy filing. Column (1) in Table 3.9 shows the results from a regression of the out of business indicator on log sales interacted with the pro-debtor dummy is positive but just marginally insignificant (the t-statistic is about 15%). The same pattern holds in column (2) which reports the interaction between the pro-debtor indicator and the incorporation dummy. This suggests that likelihood of re-filing increases even more for larger, incorporated firms when they are allocated to a pro-debtor judge.

In columns (3) and (4) we repeat the same regressions using the log change in sales four years out as the dependent variable. The sign on the interaction terms is negative but not significant. Columns (5) and (6) [(7) and (8)] replicate the regressions using PAYDEX min (PAYDEX max) four years out as the dependent variable, respectively. These are the credit scoring variables available from NETS. We find that the coefficient on the interaction terms is negative and significant at the 5% level in all the regressions. Overall these results suggest that a pro-debtor judge has worse effects on firms' continuation values in larger and incorporated firms. These findings

[13] We are in the process of obtaining information on the capital structure and asset base of the firms at the moment of bankruptcy filing from their Chapter 11 filing documents.

are consistent with the interpretation that pro-debtor judges create an environment that exacerbates the governance problems between managers and shareholders. The results do not support the interpretation that owner-managers (of small companies) transfer value out of the firm during the Chapter 11 process.[14]

3.7 Outcomes of Individual Decisions

Finally want to explore whether specific rulings in Chapter 11 have an impact on the outcome of a case. This analysis aims to understand whether there are specific dimensions of the pro-debtor or pro-creditor index that are particular important for a given outcome. We do not however want to claim that this analysis proves that only those dimensions matter since there might be other, potentially even procedural dimensions, through which a judges can affect the bankruptcy process.

We therefore take an alternate approach for our analysis. We use the estimated judge fixed effects as an instrument for each specific ruling. This allows us identify the impact of a specific ruling based on the judges pre-disposition to rule in favor or against a certain motion based not on the characteristics of the case but on the an individual judge's predispositions or biases. As discussed above we cannot simply look at the correlation between judge rulings and outcomes in the cross section, since judge decisions are likely related to the unobservable characteristics of the case. Since we cannot obtain consistent estimates via OLS, we use an instrumental variable approach with the judge fixed effects as our instruments.

Specifically we run:

$$y_i = \alpha_{dt} + \gamma_i + \beta X_{it} + \Lambda A_{ij} + \eta_j + \epsilon_i \tag{3.2}$$

where y_i is the outcome of interest and α_{dt}, γ_i and βX_{it} are defined as before.

[14] Of course we cannot in our data rule out that owner-managed firms might have already transferred assets out of the firm prior to filing for Chapter 11.

An additional error term η_j is included to reflect the potential clustering of error at the judge level due to our instrument. A_{ij} represents the vector of rulings in case i instrumented by the assigned judge's fixed effects (e.g. his or her relative propensity for each specific rulings). Since a judge propensity for a given action is almost entirely independent of any *one* case and highly correlated with the action itself, they provide almost ideal instruments for our analysis. We restrict our set of independent variables to the rulings that were significant in the first stage.

As discussed above we can only meaningfully include the granting of a motion but not a denial, since denials are a combination of the judge's likelihood to approve a motion and the endogenous response by the parties in bankruptcy to file a motion. The two forces move in opposite directions and could therefore bias the results in an indeterminate direction.

Table 3.10 reports our results for bankruptcy re-filing rates as the outcome variable. We construct an index variable equal to one if a firm re-files for bankruptcy within the next three years after the first filing.[15] In column (1) of Table 3.10 we see that in the simple OLS regression without using our instrumentation strategy, none of the motions are significant. However, once we instrument the different motions with the judge fixed effect we see in column (2) that a number of different motions have a significant relationship to refiling. Especially significant are extensions of the exclusivity period and permitting the debtor to us cash collateral.

We also replicated the results for the outcome variables in the smaller sample of NETS data. While the results tend to have the expected signs on the judge decisions, the sample size is too small to find any significant results.

3.8 Conclusion

Our study suggests that there is large heterogeneity in the ruling of judges in Chapter 11. Independent of the characteristics of the case, some judges seem to have a

[15] We replicated this regression for different windows of years after the bankruptcy filings, and the results are virtually unchanged.

differential propensity to rule in favor of creditors or debtors. When we use these judge specific differences to proxy for the pro-debtor (pro-creditor) friendliness of a court, we find that judges who score higher on our pro-debtor index tend to have lower continuation, higher re-filing rates and also show a larger deterioration of credit scores in the 3, 4, and 5 years after coming out of Chapter 11. These results are quite counter-intuitive since at the margin equity holders who have limited liability should be more concerned about continuation.

We conjecture that a failure of governance within firms could be at the core of these findings. If the interest of equity is not adequately represented in the bankruptcy process, more specifically, if management is able to extract private financial benefits during the restructuring process, it might come at the expense of the long term continuation value for equity holders. An alternative explanation would be that a restructuring process that is tilted towards debtors allows equity itself to extract financial resources from the firm instead of keeping assets tied up in firm. For example, owner-managers who are in control of day-to-day management of the firm might be able to take the most important assets out of the firm ad set up a similar firm in parallel. If this extraction technology for equity is not too inefficient, continuation might be less attractive than a prolonged bankruptcy process and potential shut down, since in continuation the owners would have to share future income with other claim holders.

Ignoring these important implications firm level governance plays in the restructuring of distressed firms might result in policy implications that are not in the interest of the parties they are supposed to protect. Going forward much more research is needed to understand how distress resolution interacts with the governance structure of firms that enter distress.

3.A Appendix: Tables

Table I
Variable Descriptions

Name	*Source*	*Description*
Case Duration	*PACER*	The number of days between the first and last docket filing.
Corporation	*Dun & Bradstreet*	A dummy for whether a firm is a formal corporation.
Credit Rating	*Dun & Bradstreet*	D & B's proprietary composite measure of credit worthiness.
Employees	*Dun & Bradstreet*	Total number of employees for the year *before* bankruptcy filing.
Out of Business	*NETS*	A dummy for whether a firm disappears from the D&B universe within three years of filing for Chapter 11.
PAYDEX	*NETS*	PAYDEX is a dollar-weighted 1-100 numerical score that indicates a company's payment performance as reported to D&B. Higher scores are better.
PAYDEX min	*NETS*	Minimun PAYDEX score during a calendar year.
PAYDEX max	*NETS*	Maximum PAYDEX score during a calendar year.
Refile	*PACER*	Whether a firm refiles for bankruptcy in the *same* district within three years.
Sales	*Dun & Bradstreet*	Total sales for the year *before* bankruptcy filing.
Voluntary	*PACER*	A dummy for whether a firm voluntarily filed for Chapter 11.

Table II
Descriptive Statistics[a]

Panel A	*Firm level data: Dun & Bradstreet*				
	Mean	*Std. Dev.*	*Min Val.*	*Max Val.*	*Count*
Sales	1.7 million	510,000	750	55 million	5465
Employees	21.75	103.81	0	2,500	5465
Refile Rate	0.03	0.17	0	1	5465
Corporation	0.62	0.49	0	1	5465
Voluntary	0.97	0.16	0	1	5465
Credit Rating	0.41	1.29	0	5	1060
Panel B	*Firm level data: NETS*				
	Mean	*Std. Dev.*	*Min Val.*	*Max Val.*	*Count*
Sales	2.7 million	7.0 million	15,000	150 million	1813
Employees	23.86	54.69	1	1,500	1817
Refile Rate	0.04	0.19	0	1	1813
Corporation	0.77	0.42	0	1	1813
Voluntary	0.98	0.13	0	1	1813
Credit Rating	0.71	1.64	0	5	464

[a]Notes:

1. The sample in Panel A is the firm-level panel dataset constructed from the merged PACER and Dun & Bradstreet datasets (see text for more details.) The sample period is 1998-2004.
2. The sample in Panel B contains only those firms that we were able to match to records in the NETS database.

Table III
Descriptive Statistics by Judge Bias[a]

Panel A — *Firm level data*

	Pro-Debtor Judges		*Pro-Creditor Judges*	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
log(Sales)	12.99	1.73	12.99	1.94
log(Employees)	1.72	1.60	1.72	1.77
Refile Rate	0.33	0.17	0.23	0.15
Corporation	0.67	0.47	0.65	0.48
Voluntary	0.98	0.15	0.98	0.16
Credit Rating	0.29	1.10	0.22	0.97

Panel B — *Industry Breakdown by District*

	Pro-Debtor Judges	*Pro-Creditor Judges*
SIC 1*	7.04%	7.70%
SIC 2*	4.61%	3.50%
SIC 3*	4.95%	3.50%
SIC 4*	4.56%	4.55%
SIC 5*	20.15%	15.65%
SIC 6*	21.99%	22.61%
SIC 7*	25.73%	32.09%
SIC 8*	10.68%	10.23%
SIC 9*	0.29%	0.17%

[a]Notes:

1. Panel A compares the characteristics of firms assigned to pro-debtor and pro-creditor judges. With the exception of the refiling rate, the two samples are almost identical.
2. Panel B compares the composition of firms by industry as defined by the first digit of their SIC code.

Table IV
Cases by Year[a]

Panel A				*Case Count by District: Dun & Bradstreet*					
	AZ	*CA-LA*	*CA-ND*	*CA-RS*	*CA-SA*	*CA-SV*	*N-GA*	*NJ*	Total
1998	64	34	90	25	45	29	36	18	260
1999	70	61	6	14	35	21	31	40	278
2000	91	80	6	25	48	37	44	47	378
2001	74	130	17	21	66	34	39	63	444
2002	32	59	9	18	33	20	39	55	265
2003	9	78	12	19	32	23	7	5	185
2004	0	22	3	12	12	5	0	0	54
Total	340	464	62	134	271	169	196	228	1,884

Panel B				*Case Count by District: NETS*					
	AZ	*CA-LA*	*CA-ND*	*CA-RS*	*CA-SA*	*CA-SV*	*N-GA*	*NJ*	Total
1998	41	13	5	11	16	7	24	12	129
1999	42	26	3	10	11	12	20	19	132
2000	41	31	1	7	19	17	23	21	160
2001	27	42	5	10	16	16	15	23	154
2002	21	24	5	15	22	9	21	26	143
2003	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0
Total	161	136	19	53	84	61	103	101	718

[a]Notes:

1. The time variation in the number of bankruptcies in each district is due to three factors. The gradual decrease or increase in case volume is simply due to differential district time trends. The sharp decline in case volume for the final two years of our sample is largely due to variation in timeliness of data entry by the different districts. And finally in the NETS sample is simply due to the fact that we were unable to assemble a suitable panel for cases filed in more recently than 2002.

Table V
Frequency of Filings[a]

	Dun & Bradstreet					Sub-Sample				
	Filing Count		Judge Fixed Effect			Filing Count		Judge Fixed Effect		
	Mean	Std. Dev.	F(50,1763)	Prob>F	LRT	Mean	Std. Dev.	F(48,631)	Prob>F	LRT
CC Agreed	0.001	0.023	1.39	0.04	>0.10	0.003	0.055	0.97	0.54	>0.10
CC Grant	0.015	0.123	1.62	0.00	0.00	0.011	0.104	1.80	0.00	0.00
CC Deny	0.149	0.356	1.19	0.18	0.00	0.132	0.338	2.14	0.00	0.05
Conv 7	0.038	0.192	1.31	0.07	0.00	0.019	0.136	1.69	0.00	0.05
Conv Unknown	0.027	0.161	1.11	0.28	0.00	0.021	0.143	2.56	0.00	>0.10
Conv Deny	0.008	0.089	1.07	0.35	>0.10	0.005	0.070	1.28	0.07	>0.10
Dismiss Grant	0.029	0.167	1.32	0.07	0.00	0.025	0.156	3.23	0.00	>0.10
Dismiss Deny	0.541	0.498	1.96	0.00	0.00	0.559	0.496	5.60	0.00	0.00
Exclusive Grant	0.002	0.040	0.59	0.99	>0.10	0.002	0.048	0.98	0.53	>0.10
Exclusive Deny	0.024	0.153	0.72	0.93	0.10	0.018	0.133	1.23	0.12	0.01
JudgeSub Grant	0.000	0.000	N/A	N/A	N/A	0.000	0.020	1.14	0.22	N/A
JudgeSub Deny	0.062	0.240	1.34	0.06	>0.10	0.051	0.219	2.84	0.00	0.10
LiftStay Grant	0.068	0.253	1.55	0.01	0.00	0.048	0.215	2.26	0.00	>0.10
LiftStay Deny	0.254	0.436	1.83	0.00	0.00	0.167	0.373	3.43	0.00	0.00
Objection Debtor	0.003	0.051	0.64	0.98	0.00	0.002	0.044	2.48	0.00	>0.10
Objection Creditor	0.004	0.065	0.53	1.00	0.00	0.005	0.069	1.64	0.00	>0.10
Sale Grant	0.003	0.051	0.50	1.00	>0.10	0.004	0.064	0.86	0.77	>0.10
Sale Deny	0.012	0.110	1.03	0.41	0.00	0.001	0.094	2.63	0.00	0.00
SuaSponte	0.006	0.076	2.94	0.00	0.10	0.002	0.048	7.88	0.00	0.01

[a]Notes:

1. Summary statistics are provided for both the full Dun & Bradstreet sample and a Dun & Bradstreet sub-sample that drops all cases that were filed before 1998 and cases filed by firms in the top and bottom decile in yearly sales. The results of a joint F test on judge fixed effects for a given filing show that fixed effects for commonly occuring filings are significant for both the full and sub-sample.

Table VI
Random Assignment[a]

	Judge F.E. for Sales and Employment							
	Full Sample				*Dropping Judges with <10 Cases*			
Panel A	Dunn & Bradstreet							
log(Sales)								
Number of Cases	1884	1884	1884	1884	1851	1851	1851	1851
Number of Judges	53	53	53	53	48	48	48	48
Prob > F	0.00	0.24	0.37	0.35	0.10	0.32	0.45	0.45
Number of Employees								
Number of Cases	1864	1864	1864	1864	1851	1851	1851	1851
Number of Judges	53	53	53	53	48	48	48	48
Prob > F	0.39	0.97	0.97	0.98	0.27	0.93	0.93	0.93
Panel B	NETS							
log(Sales)								
Number of Cases	718	718	718	718	711	711	711	711
Number of Judges	53	53	53	53	48	48	48	48
Prob > F	0.53	0.65	0.75	0.77	0.46	0.66	0.75	0.77
Number of Employees								
Number of Cases	1864	1864	1864	1864	1851	1851	1851	1851
Number of Judges	53	53	53	53	48	48	48	48
Prob > F	0.41	0.46	0.46	0.46	0.32	0.26	0.27	0.27
District Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry F.E.	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Corporation dummy	No	No	Yes	Yes	No	No	Yes	Yes
Voluntary Filing dummy	No	No	No	Yes	No	No	No	Yes

[a]Notes:

1. The table reports the results of a joint F test for all judge coefficients.
2. For comparison, it should be noted that with the exception of the change in sales in years one and two post filing, and the change in employment in years one, two and three post filing the F test for equivalence of the judge fixed effect could be rejected at the 0% level for all our outcome variables.

Table VII
ProDebtor Dummy Results[a]

Panel A	*Pro-Debtor Dummy Coefficient*	
	Dun & Bradstreet	*NETS*
Refile	0.017	0.014
	(0.006)**	(0.017)
Count	1,864	718
Log(Case Duration)	0.002	0.079
	(0.108)	(0.122)
Count	1,827	704
Out of Business	0.056	0.042
	(0.018)*	(0.043)
Count	718	718

Panel B	*Panel Data*				
	Years after Initial Filing				
	1	*2*	*3*	*4*	*5*
D&B Credit Rating		0.001	0.019	-0.086	-0.183
		(0.010)	(0.019)	(0.037)*	(0.101)+
Sales	-0.064	-0.049	-0.090	-0.194	-0.242
	(0.046)	(0.045)	(0.059)	(0.099)+	(0.127)+
Employees	-0.040	-0.032	-0.058	-0.069	-0.014
	(0.041)	(0.048)	(0.050)	(0.091)	(0.130)
Paydex Min	-0.027	-0.104	-0.242	-0.081	-0.130
	(0.113)	(0.126)	(0.157)	(0.137)	(0.152)
Paydex Max	-0.072	-0.036	-0.092	-0.088	-0.028
	(0.059)	(0.063)	(0.120)	(0.096)	(0.040)

[a]Notes:

1. + Significant at 10%; * Significant at 5%; ** Significant at 1%
2. The D&B Credit Rating was run on the Dun & Bradstreet dataset. All other outcomes in Panel B are from the NETS dataset.

Table VIII
ProDebtor/ProCreditor Dummy Results[a]

Panel A	*Dun & Bradstreet*		*NETS*	
	ProDebtor	*ProCreditor*	*ProDebtor*	*ProCreditor*
Refile	0.017	-0.002	0.011	0.013
	(0.006)**	(0.007)	(0.016)	(0.015)
Count	1864		718	
Log(Case Duration)	0.036	-0.194	0.093	-0.067
	(0.102)	(0.103)+	(0.124)	(0.122)
Count	1827		704	
Out of Business	0.056	-0.002	0.037	0.019
	(0.021)*	(0.023)	(0.044)	(0.041)
Count	1864		718	

[a]Notes:

1. + Significant at 10%; * Significant at 5%; ** Significant at 1%
2. For a description of how the pro-debtor and pro-creditor dummies were constructed, please refer to Section 6 of the text.

Table IX
Pro-Debtor Interaction Coefficients[a]

	Out of Business		*ΔLog(Sales)*		*ΔPAYDEX (min)*		*ΔPAYDEX (max)*	
Pro-Debtor	0.012	-0.230	-0.026	0.253	0.677	7.801	0.240	3.452
	(0.026)	(0.207)	(0.168)	(1.448)	(0.430)	(3.566)*	(0.172)	(1.795)+
Corporation	0.178		0.012		0.748		0.103	
	(0.032)**		(0.085)		(0.365)*		(0.100)	
*PD*Corp*	0.060		-0.068		-0.901		-0.407	
	(0.042)		(0.189)		(0.444)*		(0.176)*	
Log(Sales)		0.043		-0.321		0.430		0.175
		(0.009)**		(0.058)**		(0.124)*		(0.112)
*PD*Log(Sales)*		0.023		-0.033		-0.554		-0.250
		(0.016)		(0.109)		(0.258)*		(0.128)+

[a]Notes:

1. + Significant at 10%; * Significant at 5%; ** Significant at 1%
2. The independent variable *Log(Sales)* represents the yearly sales volume of a firm the year of filing.
3. Out of Business indicates whether a business is deemed a non-existent entitity within four years of filing.
4. Δ*Log(Sales)* and Δ*PAYDEX* are the difference between the value the year of filing and 4 years after filing.

Table X
Refiling IV Results[a]

Effect of judge decisions on re-filing rate

	OLS		*IV*	
Cash Collateral@	0.008	0.008	0.505	0.507
	(0.023)	(0.023)	(0.190)**	(0.190)**
Convert to Ch. 7	-0.014	-0.015	-0.218	-0.223
	(0.018)	(0.018	(.159)	(.160)
Dismiss Case	-0.22	-0.22	0.170	0.165
	(0.017)	(0.017)	(0.127)	(.127)
Extend Exclusivity Period@	-0.004	-0.004	1.057	1.069
	(0.052)	(0.052)	(.567)**	(.567)**
Lift Automatic Stay	-0.007	-0.007	-0.100	-0.097
	(0.012)	(0.012)	(0.098)	(0.098)
Sale of Asset@	-0.022	-0.022	-0.282	-0.284
	(0.038)	(0.038)	(0.465)	(0.466)
Log(Sales)		-0.001		-0.001
		(0.002)		(0.002)
Observations	4857	4857	4823	4823

[a]Notes:

1. The table shows the effect of each action instrumented by the judge's fixed effects on re-filing rates. The dependent variable has been detrended at the *district*∗*year* level. Standard errors are in parenthesis.
2. @ Debtor filed actions
3. + Significant at 10%; * Significant at 5%; ** Significant at 1%

Table XI
Sample of Judge Fixed Effects[a]

	Judge Fixed Effects							
	Cash Collateral		*Convert*		*Dismiss*		*Lift Stay*	
	Grant	*Deny*	*Grant*	*Deny*	*Grant*	*Deny*	*Grant*	*Deny*
Ahart AA	0.051	-0.912	-0.285	-0.123	-1.049	0.455	0.543	-0.774
	-0.313	(0.007)**	-0.123	-0.378	(0.000)**	(0.048)*	(0.056)+	(0.001)**
Alberts RA	0.066	-0.827	-0.269	-0.11	-1.013	0.367	0.581	-0.8
	-0.216	(0.013)*	-0.144	-0.426	(0.000)**	(0.097)+	(0.040)*	(0.001)**
Barr JB	0.055	-0.878	-0.23	-0.123	-1.055	0.262	0.512	-0.792
	-0.288	(0.008)**	-0.218	-0.375	(0.000)**	-0.248	(0.071)+	(0.001)**
Bluebond BB	0.047	-0.764	-0.262	-0.122	-1.075	0.133	0.466	-0.781
	-0.348	(0.025)*	-0.16	-0.381	(0.000)**	-0.569	-0.101	(0.001)**
Bufford SB	0.061	-0.887	-0.266	-0.123	-1.022	0.187	0.514	-0.923
	-0.245	(0.008)**	-0.153	-0.376	(0.000)**	-0.417	(0.071)+	(0.000)**
C. Ray Mullins	0.005	-0.124	0.056	-0.042	0.02	-0.015	0.039	0.201
	-0.708	-0.177	-0.194	-0.326	-0.764	-0.87	-0.688	(0.097)+
Carroll EC	0.076	-0.801	-0.26	-0.124	-1.071	0.391	0.526	-0.863
	-0.164	(0.017)*	-0.163	-0.374	(0.000)**	(0.091)+	(0.064)+	(0.000)**
Carroll PC	0.168	-0.735	-0.308	-0.122	-0.957	0.206	0.48	-0.549
	(0.042)*	(0.035)*	(0.096)+	-0.38	(0.000)**	-0.386	(0.092)+	(0.030)*
C. G. Case II	0.039	-1.148	-0.341	-0.103	-1.059	1.073	0.121	-1.018
	-0.384	(0.000)**	(0.053)+	-0.457	(0.000)**	(0.000)**	-0.42	(0.000)**
D. H. Steckroth	0.02	-1.026	-0.398	-0.13	-1.118	0.377	0.688	-0.241
	-0.795	(0.001)**	(0.027)*	-0.356	(0.000)**	-0.267	(0.033)*	-0.339
Donovan TD	0.062	-0.853	-0.285	-0.123	-1.065	0.243	0.486	-0.657
	-0.24	(0.011)*	-0.124	-0.375	(0.000)**	-0.292	(0.086)+	(0.006)**
E. W. Hollowell	0.041	-1.034	-0.334	-0.118	-1.077	0.91	0.104	-1.092
	-0.368	(0.000)**	(0.059)+	-0.394	(0.000)**	(0.000)**	-0.49	(0.000)**
G. B. Nielsen Jr.	0.041	-1.151	-0.353	-0.108	-1.079	1.223	0.096	-1.057
	-0.358	(0.000)**	(0.045)*	-0.438	(0.000)**	(0.000)**	-0.523	(0.000)**
Gloria M. Burns	0.091	-0.901	-0.364	-0.126	-1.16	0.452	0.724	-0.385
	-0.301	(0.006)**	(0.049)*	-0.368	(0.000)**	-0.193	(0.025)*	-0.13
Goldberg MG	0.045	-0.811	-0.275	-0.123	-1.071	0.105	0.458	-0.641
	-0.372	(0.016)*	-0.138	-0.377	(0.000)**	-0.647	-0.105	(0.008)**
Greenwald AG	0.059	-0.849	-0.241	-0.124	-1.065	0.176	0.467	-0.856
	-0.254	(0.011)*	-0.196	-0.374	(0.000)**	-0.44	(0.099)+	(0.000)**
Helen S. Balick	0.003	-0.354	0	0	0.006	-0.082	-0.006	-0.021
	-0.545	(0.088)+	-0.219	-0.672	-0.61	-0.617	-0.332	-0.633
Hugh Robinson	-0.026	-0.176	-0.005	0.059	0.169	0.276	-0.108	0.096
	-0.143	(0.022)*	-0.852	-0.331	-0.125	(0.009)**	-0.253	-0.477
James E. Massey	-0.007	-0.177	0.014	-0.017	-0.006	-0.027	-0.089	-0.096
	-0.412	(0.021)*	-0.725	-0.582	-0.923	-0.774	-0.284	-0.385
J. J. Farnan Jr	0.005	-0.36	0	0	0.006	0.529	0	0.17
	-0.437	-0.125	-0.124	-0.952	-0.649	(0.014)*	-0.942	-0.113

[a]Notes:

1. This table shows a sampling of some of the judge fixed effects (i.e. a judge's propensity for various actions) controlling for SIC and $district * year$ trends. Standard errors are in parenthesis. The results have proven quite robust to variation in the control variables (Sales, Employees, Voluntary, Corporation) and to the use of subsets of the data (e.g. dropping districts, dropping low volume judges, dropping cases that are dismissed or converted).
2. $^{+}$ Significant at 10%; * Significant at 5%; ** Significant at 1%

Bibliography

[1] Administrative Office of the U.S. Courts, *Press Release*, December 2004.

[2] Aghion, Philippe, Oliver Hart and John Moore, 1992, "The Economics of Bankruptcy Reform," *Journal of Law, Economics and Organization,* vol. 8(3), p 523-546.

[3] Alesch, Daniel J. and William J. Petak, 2004. "Seismic Retrofit of California Hospitals: Implementing Regulatory Policy in a Complex and Dynamic Environment," *Natural Hazards Review,* 5(2): 89-94.

[4] Altman, Stuart H. and Mary G. Henderson, "Introduction," S. H. Altman, C. Brecher, M. G. Henderson and K. E. Thorpe, Competition and Compassion. Ann Arbor, Michigan: Health Administration Press, 1989,

[5] Anderson, J., Kling, R. and Stith, K., 2001, "Measuring Inter-Judge Sentencing Disparity Before and After the Federal Sentencing Guidellines," *Journal of Law and Economics,* Vol. 42, p. 271-307.

[6] Arrow, Kenneth .J., 1963. "Uncertainty and the Welfare Economics of Medical Care," *American Economic Review*, 53(5): 941973.

[7] Bailey, Willard, 1989. "Charity care: a matter of mission, fund raising and survival," *Fund Raising Management*, March 1 1989.

[8] Baird, Douglas and Edward Morrison, 2001, "Bankruptcy Decision Making," *Journal of Law, Economics and Organizations*, Vol. 17, p. 356-371.

[9] Baird, Douglas and Edward Morrison, 2005, "Serial Entrepreneurs and Small Business Bankruptcies," Working Paper Columbia law School.

[10] Baird D., and Rasmussen, P., 2002, "The End of Bankruptcy," *Stanford Law Review,* p. 751.

[11] Baird D., and Rasmussen, P., 2003, "Chapter 11 at Twilight," *Stanford Law Review,* p. 101-129.

[12] Bayus, Barry and William Putsis, "Product Proliferation: An Empirical Analysis of Product Line Determinants and Market Outcomes," *Marketing Science,* 18(2) (1999), 137-153.

[13] Becker, Edmund R. and Frank R Sloan, 1985. "Hospital Ownership and Performance," *Economic Inquiry,* 23(1): 21-36.

[14] Berglof, E and E.L. von Thadden, 1994, "Short-Term Versus Long-Term Intrests: Capital Structure with Multiple Investors," *Quarterly Journal of Economics,* Vol. 109, p. 1055-1084.

[15] Bergman, Y. Z., and Callen, J. L., 1991, "Opportunistic Underinvestment in Debt Renegotiation and Capital Structure," *Journal of Financial Economics,* Vol. 29, p. 137-171.

[16] Betker, B., 1995, "Management's Incentive, Equity Bargaining Power and Deviation from Absolute Priority in Chapter 11 Bankruptcies," *Journal of Business,* Vol. 68, p. 161-184.

[17] Blecher, Michele Bitoun, 1997. "Capital: Who's Got It? How to Get It!" *Hospitals & Health Networks,* 71(12): 38-40.

[18] Bolton, P. and D. Scharfstein, 1996, "Optimal Debt Structure with Multiple Creditors," *Journal of Political Economy,* Vol. 104, p. 1-25.

[19] Brander, James A. and Jonathan Eaton, "Product Line Rivalry," *The American Economic Review,* 74(3) (1984), 323-334.

[20] Bradley, M., and Rosenzweig, M., 1992, "The Untenable Case for Chapter 11," *Yale Law Journal,* 101, p. 10431095.

[21] Bris, A., Welch, I. and Zhu, N., 2006, "The Costs of Bankruptcy," *Journal of Finance,* Vol. 61(3), p. 1253-1303.

[22] Buchmueller, Tom, Mireille Jacobson and Cheryl Wold, 2006. "How Far to the Hospital? The Effect of Hospital Closures on Access to Care," *Journal of Health Economics,* 25(4): 740-761.

[23] Carpenter, Gregory and Rashi Glazer, and Kent Nakamoto, "Meaningful Brands from Meaningless Differntiation: The Dependence on Irrelevant Attributes," *Journal of Marketing Research,* 31 (1994), 339-350.

[24] Chakravarti, Amitav and Chris Jaiszewski, "The Influence of Macro-Level Motives on Consideration Set Composition in Novel Purchase Situations," *Journal of Consumer Research,* 30 (2003), 244-258.

[25] Chang, Tom, Sendhil Mullainathan and Eldar Shafir, "Experiments in Choice," *Mimeo,* MIT, (2008).

[26] Congressional Budget Office (CBO), 2006. "Nonprofit Hospitals and the Provision of Community Benefits," CBO Paper.

[27] Cutler, David M. and Jill R. Horwitz 2000. Converting Hospitals from Not-for-Profit to For-Profit Status: Why and What Effects?, in David Cutler (ed.) *The Changing Hospital Industry,* Chicago: University of Chicago Press.

[28] Dafny, Leemore S., How Do Hospitals Respond to Price Changes?, *American Economic Review* 95(5): 1525-1547.

[29] David, Guy, 2007. "The Convergence between For-Profit and Nonprofit Hospitals in the United States," mimeo.

[30] Duggan, Mark, 2000. "Hospital Ownership and Public Medical Spending," *The Quarterly Journal of Economics,* 115(4): 1343-1373.

[31] Duggan, Mark, 2002. "Hospital Market Structure and the Behavior of Not-for-Profit Hospitals," *RAND Journal of Economics,* 33(3): 433-446.

[32] DellaVigna, S. and U. Malmendier, "Contract Design and Self-Control: Theory and Evidence," *Quarterly Journal of Economics,* 119 (2004), 353-402.

[33] DellaVigna, S. and U. Malmendier, "Paying Not to Go to the Gym," *American Economic Review,* 96 (2006), 694-659.

[34] Dewatripoint, M and J. Tirole, 1994, "A Theory of Debt and Equity: Diversity of Securities and Manager-Shareholder Congruence," *Quarterly Journal of Economics,* Vol. 109, p. 1027-1054.

[35] Easley, David, and Maureen OHara, 1983. "The Economic Role of the Nonprofit Firm, *Bell Journal of Economics* 14(2): 531-38.

[36] Eisenberg, Theodore and Lynn LoPucki, 1999, "Shopping for Judges: An empirical Analysis of Venue Choice in Large Chapter 11 Reorganizations," *Cornell Law Review*, Vol. 48.

[37] Eliaz, Kfir and Ran Spiegler, "Consideration Sets and Competitive Marketing," *Mimeo,* (2007).

[38] Eliaz, Kfir and Ran Spiegler, "Contracting with Diversely Nave Agents," *Review of Economic Studies,* 73 (2006), 689-714.

[39] Ellison, Glenn, "A Model of Add-On Pricing," *Quarterly Journal of Economics,* 120 (2005), 585-638.

[40] Ellison, Glenn, "Bounded Rationality in Industrial Organization," in *Advances in Economics and Econometrics: Theory and Applications, Ninth World Congress, Volume II,* ed. by R. Blundell, W. Newey, and T. Persson. Cambridge University Press, Cambridge (2006).

[41] Ellison, Glenn and Richard Holden, "A Theory of Rule Development," *Mimeo,* MIT (2008).

[42] Erus, Burcay and Burton A. Weisbrod, 2003. "Objective Functions and Compensation Structures in Nonprofit and For-profit Organizations: Evidence from the mixed Hospital Industry. in Edward L. Glaeser (ed.) *The Governance of Not-for-Profit Organizations*, Chicago: University of Chicago Press.

[43] Ferrandiz, J. M., "The Impact of Generic Goods in the Pharmaceutical Industry," *Health Economics,* 8(7) (1999), 599-612.

[44] Francis, Theo, 2007. "Lawmakers Question if Nonprofit Hospitals Help the Poor Enough," *The Wall Street Journal,* July 20, 2007.

[45] Frank, Richard G. and David S. Salkever, 1991. "The Supply of Charity Services by Nonprofit Hospitals: Motives and Market Structure," *The RAND Journal of Economics,* 22(3): 430-445.

[46] Fryer, Roland and Mark Jackson, "A Categorical Model of Cognition and Biased Decision-Making," *Contributions in Theoretical Economics, B.E. Press,* Forthcoming (2008).

[47] Gabaix, Xavier and David Laibson, "Shrouded Attributes, Consumer Myopia, and Informational Suppression in Competitive Markets," *Quarterly Journal of Economics,* 121 (2006), 505-540.

[48] Gaumer, G. Medicare Patient Outcomes and Hospital Organizational Mission. In B.H. Gray, ed., *For-Profit Enterprise in Health Care.* Washington, D.C.: National Academy Press, 1986.

[49] Gaynor, Martin and William Vogt, 2003. "Competition among hospitals," *RAND Journal of Economics,* 34(4): 764-785.

[50] Gertner, Robert and David Scharfstein, 1991, "A Theory of Workouts and the Effects of Reorganization Law," *Journal of Finance,* Vol. 46, p. 1189-1221.

[51] Gilson, S. C., and M. R. Vetsuypens, 1993, "CEO Compensation in Financially Distressed Firms: An Empirical Analysis," *Journal of Finance,* Vol. 43, p. 425-458.

[52] Glaeser, Edward L. and Andrei Shleifer, 2001. "Not-for-Profit Entrepreneurs," *Journal of Public Economics,* 81(1): 99-115.

[53] Glaeser, Edward L., 2003. *The Governance of Not-for-Profit Organizations,* Chicago: The University of Chicago Press.

[54] Grossman, Sanford and Oliver D. Hart, 1982. "Corporate financial structure and managerial incentives, in John J. McCall, ed.:," *The Economics of Information and Uncertainty,* (University of Chicago Press, Chicago, Il).

[55] Gruber, Jonathan, 1994. "The Effect of Competitive Pressure on Charity: Hospital Responses to Price Shopping in California," *Journal of Health Economics,* 38(13): 183-212.

[56] Hansmann, Henry, 1981. "The Rationale for Exempting Nonprofit Organizations from Corporate Income Taxation," *The Yale Law Journal,* 91(1): 54-100.

[57] Hansmann, Henry, 1996. *The Ownership of Enterprise,* Cambridge, MA: The Belknap Press.

[58] Hart, Oliver, 1991. "Theories of optimal capital structure: A principal agent approach," *Brookings Discussion Paper,* 91-2.

[59] Hart, Oliver, 2000, "Different Approaches to Bankruptcy," *Harvard Institute of Economic Research Working paper.*

[60] Hart, Oliver and Andrei Shleifer and Robert W. Vishny, 1997. "The Proper Scope of Government: Theory and an Application to Prisons," *The Quaterly Journal of Economics,* 112(4): 1127-1161.

[61] Hauser, John and Birger Wernerfelt, "An Evaluation Cost Model of Consideration Sets," *Journal of Consumer Research,* 16 (1990), 383-408.

[62] Hayward, W. G. and M. J. Tarr, "Spatial language and spatial representation," *Cognition,* 55 (1995), 39-84.

[63] Hayward, W. G. and M. J. Tarr, "Testing conditions for viewpoint invariance in object recognition," *Journal of Experimental Psychology: Human Perception and Performance,* 23 (1997), 1511-1521.

[64] Heidhues, Paul and Botond Koszegi, "Competition and Price Variation when Consumers are Loss Averse," *American Economic Review,* (2008a), 98(4), 1245-1268.

[65] Heidhues, Paul and Botond Koszegi, "Exploiting Naivete about Self-Control in the Credit Market," *Mimeo,* (2008b).

[66] Hirth, Richard A. 1999. "Consumer Information and Competition between Non-profit and For-Profit Nursing Homes," *Journal of Health Economics*, 18(2): 219240.

[67] Hollis, Aidan, "The Anti-Competitive Effects of Brand-Controlled 'Pseudo-Generics' in the Canadian Pharmaceutical Market," *Canadian Public Policy,* 29(1) (2003), 21-32.

[68] Horwitz, Jill R. and Austin Nichols, 2007. "What Do Nonprofits Maximize? Non-profit Hospital Service Provision and Market Ownership Mix" NBER Working Paper no. 13246. Cambridge, Mass.: National Bureau of Economic Research.

[69] Horwitz, Jill R., 2006. "Nonprofit Ownership, Private Property, and Public Accountability" *Health Affairs,* 26: w308-w311.

[70] Horwitz, Jill R., 2005. "Making Profits And Providing Care: Comparing Non-profit, For-Profit, And Government Hospitals" *Health Affairs,* 24(3): 790-801.

[71] Hotchkiss, E., 1995, "Postbankruptcy Performance and Management Turnover," *Journal of Finance,* Vol. 50, p. 3-21.

[72] Internal Revenue Service, 2007. "Hospital Compliance Project: Interim Report" July 19, 2007.

[73] Iyengar, S and M. Lepper, "When Choice is Demotivating: Can One Desire Too Much of a Good Thing?," *Journal of Personality and Social Psychology,* 79 (2000), 995-1006.

[74] Jensen, Michael, 1986. "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," *American Economics Review,* 76: 323-329.

[75] Jensen, Michael and William H. Meckling, 1976, "A Theory of the Firm: Governance, Residual Claims and Organizational Forms," *Journal of Financial Economics,* Vol. 3(4), p. 305-360.

[76] Jones, Wanda, 2004. Renewal by Earthquake: Designing 21st Century Hospitals in Response to California's Seismic Safety Legislation, California HealthCare Foundation, March 2004. http://www.chcf.org/documents/hospitals/RenewalByEarthquake.pdf

[77] Judd, Kenneth L., "Credible Spatial Preemption," *Rand Journal of Economics,* 16(2), (1985), 153-166.

[78] Kamien, M. I., and I. Zang,"Virtual Patent Extension by Cannibalization," *Southern Economic Journal,* 66(1), (1999), 117-131.

[79] Keeler, E.B., Rubenstein, L.V., Kahn, K.L., et al., 1992. Hospital Characteristics and Quality of Care. *Journal of the American Medical Association* Vol. 268(13): 17091714.

[80] Kessler, D. P. and M. B. McClellan, 2002, "The Effects of Hospital Ownership on Medical Productivity," *Rand Journal of Economics* 33(3): 488-506.

[81] Kling, J., 2006, "Incarceration Length, Employment, and Earnings," *American Economic Review,* forthcoming 2006.

[82] Kuksov, Dmitri and J. Miguel Villas-Boas, "When More Alternatives Lead to Less Choice," *Mimeo,* (2005).

[83] Lakdawalla, Darius and Tomas Philipson, 1998. "Nonprofit production and competition. NBER WP 6377. Cambridge, Mass.: National Bureau of Economic Research.

[84] Lal, R., and C. Matutes. "Retail Pricing and Advertising Strategies." *Journal of Business*, 67, (1994), 345-370.

[85] Langdon, Davis, 2006. Construction Cost Escalation in California Healthcare Projects, Report Prepared for the California Hospital Association.

[86] Liang, B."The Anticompetitive Nature of Brand-Name Firm Introduction of Generics Before Patent Expiration," *Antitrust Bulletin,* 41 (1996), 599-635.

[87] LoPucki, L., and W. Whitford, 1993, "Patterns in the Bankruptcy Reorganization of Large, Publically Held Companies," *Cornell Law Review,* Vol. 78, p. 597-618.

[88] LoPucki, L., and Doherty, J., 2004, "The Determinants of Professional Fees in Large Bankruptcy Reorganization Cases," *Journal of Empirical Legal Studies,* .

[89] Manzini, Paul and Marco Mariotti, "Sequentially Rationalizable Choice," *American Economic Review,* 97 (2007), 1824-1839.

[90] Masatlioglu, Yusufcan and Daisuke Nakajima, "Choice by Iterative Search," *Mimeo,* University of Michigan (2008).

[91] Milgrom, Paul and John Roberts, "Price and Advertising as Signals of Product Quality," *Journal of Political Economy,* 94 (1986), 796-821.

[92] Malani, Anup, Tomas Philipson, and Guy David 2003. "Theories of firm behavior in the nonprofit sector: A synthesis and empirical evaluation," in Edward L. Glaeser (ed.), *The governance of not-for-profit organizations*, Chicago: University of Chicago Press.

[93] McClellan, Mark and Douglas Staiger 2000. "Comparing Hospital Quality at For-Profit and Not-for-Profit Hospitals," in David Cutler (ed.) *The Changing Hospital Industry*, Chicago: University of Chicago Press.

[94] Meade, Charles and Richard Hillestand, 2007. SB1953 and the Challenge of Hospital Seismic Safety in California, California HeathCare Foundation, January 2007. http://www.chcf.org/documents/hospitals/SB1953Report.pdf

[95] Meade, Charles, Jonathan Kulick, and Richard Hillestand, 2002. Estimating the Compliance Costs for California SB1953, California HeathCare Foundation, April 2002. http://www.chcf.org/documents/hospitals/ComplianceCostsForSB1953.pdf

[96] Miller, George A., "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity For Processing Information," *The Psychological Review,* 63,81-97, (1956).

[97] Mullainathan, Sendhil, "Thinking Through Categories," *Mimeo,* MIT, (2002).

[98] Mullainathan, Sendhil, Joshua Schwartzstein and Andrei Shleifer, "Coarse Thinking and Persuasion," *Quarterly Journal of Economics,* Forthcoming (2008).

[99] Myers, Stewart C., 1977, "Determinants of Corporate Borrowing," *Journal of Financial Economics,* Vol. 5, p. 147-175.

[100] Nelson, Philip, "Advertising as Information," *Journal of Political Economy,* 82 (1974), 729-754.

[101] Newhouse, Joseph, 1970. "Towards a Theory of Nonprofit Institutions: An Economic Model of a Hospital," *American Economic Review,* 60(1): 64-74.

[102] Norton, Edward C. and Douglas O. Staiger, 1994. "How Hospital Ownership Affects Access to Care for the Uninsured" *Rand Journal of Economics* 25(1): 171-185.

[103] OSHPD, 2001. Summary of Hospital Seismic Performance Ratings, Sacramento, CA.

[104] Pauly, Mark, 1987. "Nonprofit Firms in Medical Markets," *American Economic Review,* 77(2): 257-262.

[105] Pear, Robert, 2006. "I.R.S. Checking Compliance by Tax-Exempt Hospitals," *New York Times,* June 9, 2006.

[106] Peski, Marcin, "Prior Symmetry, Categorization, and Similarity-Based Reasoning," *Mimeo,* University of Chicago, (2007).

[107] Philipson, Tomas J. and Richard A. Posner, 2006 "Antitrust in the Not-for-Profit Sector" NBER WP W12132. Cambridge, Mass.: National Bureau of Economic Research.

[108] Poilane, Apollonia, "Divide and Conquer: Towards a Remedy for Choice Overload?" *Undergraduate Thesis,* Harvard, (2007).

[109] Rasmussen, R., and Thomas, R., 2000, "Timing Matters: Promoting Forum Shopping by Insolvent Corporations," *NWU Law Review,* Vol. 94, p. 1357-1391.

[110] Ravid, S., and Sundgren, S., 1998, "The Comparative Efficiency of Small-Firm Bankruptcies: A Study of the US and Finnish Bankruptcy Codes," *Financial Management,* Vol. 27(4).

[111] Roberts, John and James Lattin, "Development and Testing of a Model of Consideration Set Composition," *Journal of Marketing Research,* 28 (1991), 429-440.

[112] Roberts, John and James Lattin, "Consideration: Review of Research and Prospects for Future Insights," *Journal of Marketing Research,* 34 (1997), 406-410.

[113] Rose-Ackerman, Susan, 1996. "Altruism, Not-for-Profits, and Economic Theory," *Journal of Economic Literature,* 34: 701-728.

[114] Schlag, Karl, "Competing for Boundedly Rational Consumers," *Mimeo,* Universitat Pompeu Fabra, (2004).

[115] Schlesinger, Mark et al., 1997. Competition, Ownership and Access to Hospital Services, *Medical Care* 35(9): 974-992.

[116] Schlesinger, Mark and Bradford H. Gray, 2006. "How Nonprofits Matter in American Medicine, and What to Do About It?," *Health Affairs,* 25: W287-W303.

[117] Schlesinger, Mark and Bradford H. Gray, 2003. "Nonprofit Organizations and Health Care: Burgeoning Research, Shifting Expectations, and Persisting Puzzles," in R Steinberg and W Powell (eds), *The Nonprofit Sector: A Research Handbook*, New Haven, CT: Yale UP.

[118] Schmalensee, Richard, "Entry Deterrence in the Ready-to-Eat Breakfast Cereal Industry," *Bell Journal of Economics,* 9 (1978), 305-327.

[119] Shleifer, Andrei and Robert W. Vishny, 1991. "Takeovers in the '60s and the '80s: Evidence and Implications," *Strategic Management Journal,* 12: 51-60.

[120] Shortell, S.M. and Hughes, E.F.X., 1988. The Effects of Regulation, Competition, and Ownership on Mortality Rates Among Hospital Inpatients. *New England Journal of Medicine* 318(17): 11001107.

[121] Schultz, Carl H., Kristi L. Koenig, and Roger J. Lewis, 2003. "Implications of Hospital Evacuation after the Northridge, California, Earthquake," *The New England Journal of Medicine,* 348(14): 1349 - 1355.

[122] Shapiro, Jesse, "A 'Memory-Jamming' Theory of Advertising," *Mimeo,* University of Chicago, (2006).

[123] Shugan, Steven M., "The Cost of Thinking," *Journal of Consumer Research,* 7 (1980), 99-111.

[124] Silverman Elaine and Jonathan Skinner, 2005. Medicare Upcoding and Hospital Ownership, *Journal of Health Economics* 23(2): 369-389.

[125] Skeel, David A., 2003, "Creditors' Ball: The 'New' New Corporate Governance in Chapter 11," *University of Pennsylvania Law Review,* Vol. 152(2), p. 917-951.

[126] Sloan, Frank and Robert A. Vraciu, 1983. "Investor-owned and Not-for-profit Hospitals: Addressing Some Issues," *Health Affairs,* 2(1): 25-37.

[127] Sloan, Frank 2000. "Not-for-profit Ownership and Hospital Behavior," in Culyer, A.J. and J.P. Newhouse (eds), *Handbook of Health Economics, Volume 1* Chapter 21: 1142-1161.

[128] Sloan, Frank, GA Picone, DH Taylor Jr. and S Chou 2001. "Hospital ownership and cost and quality of care: is there a dimes worth of difference?," *Journal of Health Economics* 20(1): 1 - 21.

[129] Smith, C., and Stromberg, P., 2005, "Maximizing the value of distressed assets: Bankruptcy law and the efficient reorganization of firms," *Working Paper,* available at http://www.sifr.org/PDFs/smithstromberg(wb2005).pdf.

[130] Spetz, Joanne, Shannon Mitchell and Jean Ann Seago, 2000. "The Growth of Multihospital Firms in California," *Health Affairs,* 19(6): 224-230.

[131] Spiegler, Ran, "Competition Over Agents with Boundedly Rational Expectations," *Theoretical Economics,* 1 (2006a), 207-231.

[132] Spiegler, Ran, "The Market for Quacks," *Review of Economic Studies,* 1 (2006b), 73, 1113-1131.

[133] Stromberg, P. and Thorburn, K., 1996, "An Empirical investigation of Swedish Corporations in Liquidation Bankruptcy," *EFI research report,* Stockholm School of Economics.

[134] Thorburn, K., 2000, "Bankruptcy Auctions: Costs, Debt Recovery, and Firm Survival," *Journal of Financial Economics,* 58, p. 337-368.

[135] Train, Kenneth, *Discrete Choice Methods with Simulation*, Cambridge University Press (2003).

[136] Tversky, Amos, "Elimination by Aspects: A Theory of Choice," *Psychological Review,* 79 (1972), 281-299.

[137] Tversky, Amos and S. Sattath, "Preference Trees," *Psychological Review,* 86 (1979), 542-573.

[138] United States Bankruptcy Court: Central District of California, *Judicial Variance Survey*, March 2001.

[139] United States Bankruptcy Court: District of New Jersey, *Local Bankruptcy Rules*, August 2005.

[140] United States Bankruptcy Court: uscourts.gov, *Bankruptcy Basics*, 2006.

[141] Warren, E., 1992, "The Untenable Case for Repeal of Chapter 11," *Yale Law Journal,* 102, p. 437-479.

[142] Weiss, Lawrence and Karen Wruck, 1998, "Information Problems, conflicts of interest and asset stripping Chapter 11's failure in the case of Eastern Airlines," *Journal of Financial Economics*, Vol. 48, p. 55-97.

[143] Weisbrod, Burton, and Mark Schlesinger, 1986. "Public, private, nonprofit ownership, and the response to asymmetric information: The case of nursing homes." in S. Rose-Ackerman (ed.), *The economics of nonprofit institutions*, New York: Oxford UP.

[144] Weisbrod, Burton 1988. *The Nonprofit Economy,* Cambridge, MA: Harvard UP.

[145] Weisbrod, Burton 1978. *The Voluntary Nonprofit Sector,* Lexington, MA: Lexington Books.